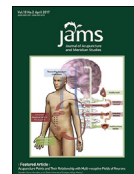


THE IMPORTANCE OF AGNIHOTRA IN VIEW OF MODERN SCIENCES



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PERSPECTIVE

Agnihotra Yajna: A Prototype of South Asian Traditional Medical Knowledge



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Abstract

This study conceptualizes the principle of agnihotra yajna. The perusal of ancient and modern literature reveals that the functioning of the human body is impossible without maintaining an energetic continuum driven by sunlight. The seven major chakras existing over the spinal cord help to maintain this energetic continuum. Agnihotra yajna is proposed to balance the chakra system as a whole by minimizing entropy. Offerings of natural elements to fire lit in a copper pyramid during agnihotra liberate various volatile compounds having potent pharmacological actions. Attempts were made to enhance the efficacy of fumes by incorporating two to three pieces of coconut endosperm and "navadhanya" (nine grains) to the conventional fire oblations. This investigation clearly demonstrates that the purpose behind the practice of agnihotra yajna is "letting incessant flow of energy (LIFE)" through our meridian lines and acupuncture points. The volatile organic compounds in smoke were analyzed using the gas chromatography–mass spectrometry method, and the results are discussed.

1. Introduction

The human body is a resonating crystal [1] that can receive and emit varying levels of frequencies in response to internal and external stimuli. As the functional aspects of human body systems revolve around three scientific terms, energy, entropy, and electron flow, nature is always meticulous in maintaining the homeostasis of the energetic components of the earth. Since ancient times, sunlight, the energy emanating from the sun, has been regarded as the ultimate source of energy available to the planet earth. A

common ritual practice in Indian Vedic culture was for every person to pray to the sun prior to beginning daily activities. This act of worshipping the sun shows that people who lived in such ages perceived the benefits that the human body harnesses when it is exposed to early morning sunlight.

Since time immemorial, smoke emanating from the combustion of various parts of medicinal plants has been used for curing diseases/disorders [2]. The significance of the ethnopharmacological aspects of medicinal smoke reveals the role of fire as a driving force in evolution [2].

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Medicinal smoke released at high temperatures has been considered to be the simplest way to administer a drug as a rapid pharmacological action can be detected upon inhalation [2]. During the period of Sushruta (800–600 BC), fumes emanating from the combustion of mustard, salt, and butter were employed to eradicate microbial pathogens from ambient air [2,3]. Smoke released by burning *Peganum harmala* and/or *Santalum album* was believed to act as a layer that protected the king from all kinds of evil and diseases [2,4]. For the prevention of bubonic plague caused by the bacterium *Yersinia pestis*, smoke released from the combustion of incense, herbs, and aromatic essences was extensively used throughout the medieval period [2,3]. Moreover, another study has detailed the therapeutic effects of medicinal smoke emanating from single- and multi-herbal formulations from 50 countries [5].

In consideration of the above facts, worth mentioning is that the great saints of Saraswati–Indus civilization (approx. 9500 years ago) performed agnihotra yajna (fire offering) in order to purify the environment, as detailed in Rigveda (oldest of Vedas), in which certain natural elements were offered to the fire that was lit in an inverted copper pyramid; this was accompanied by the chanting of mantras [2]. Although agnihotra yajna is believed to have been practiced in those days mainly for purifying ambient air, we should understand that the act and art of performing agnihotra not only cleanses the atmosphere but also reduces the total entropy of the body–mind–spirit complex by balancing and aligning the seven major energy centers in our body (chakra system) over the spinal cord that regulate the energetic continuum of every human body [6] (Figure 1). These energy centers must be properly aligned in order to allow the free flow of pure cosmic energy (PCE; otherwise known as universal prana or life force) through the vortexes formed by the perpetual rotations of these centers [1]. The concept of PCE is identical to that of

Chi (acupuncture system) and of Prana (Indian Vedic system), and it is considered to be the unprecipitated form of cosmic energy [1]. Once these chakras are aligned, the PCE absorbed by the crown chakra (“sahasrara” in Sanskrit language), which is known to be at the top of the brain, will flow freely [1]. This flow is crucial for energizing meridians and acupuncture points. If any imbalance exists in the energy flow through subtle energy channels, i.e., meridian lines, it will adversely affect our health. Most importantly, a less activated chakra will certainly have a negative effect on the endocrine gland associated with it.

In the present scientific investigation, I did an extensive survey of ancient literature and modern references to get adequate insights to conceptualize the working principle of agnihotra yajna. To perform this yajna, the performer would offer certain natural substances (usually cow dung, rice, and ghee) into the fire lit in a section of an inverted pyramid-like structure made of copper having a flat bottom (14.5 cm × 14.5 cm at the top, 5.25 cm × 5.25 cm at the bottom and 6.5 cm in height) [7]. On the basis of existing information regarding energy, entropy, meridians, chakra systems, and free electron flow, I have formulated a conceptual framework that describes the beneficial effects of agnihotra yajna. In addition, I added navadhanya (nine grains used in Indian Vedic systems) to the traditional oblations (Table 1); next, I used gas chromatography–mass spectrometry method (GC-MS) to identify the volatile components so as to evaluate the possibility of enhancing the efficacy of smoke therapy.

2. Materials and methods

This study required no ethical approval because no human or animal subjects were used. In this study, the traditional fire oblations (cow dung cake and unpolished rice), along

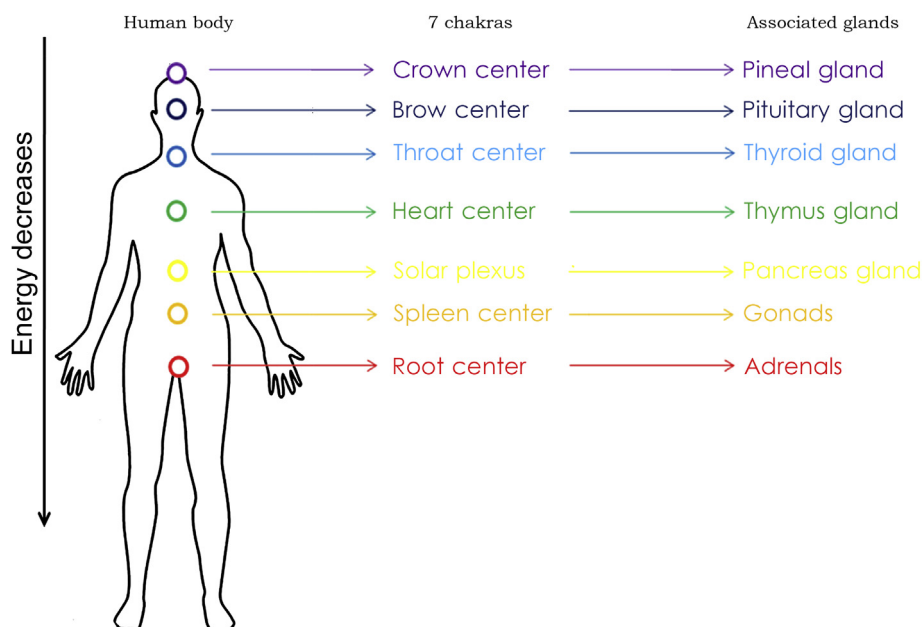


Figure 1 Chakras and associated glands.

Table 1 List of navadhanya used in certain regions of South India.

Sl. No	Navadhanya	Source
1	Wheat	<i>Triticum aestivum</i>
2	Rice	<i>Oryza sativa</i>
3	Red lentil	<i>Lens culinaris</i>
4	Green gram	<i>Vigna radiata</i>
5	Bengal gram	<i>Cicer arietinum</i>
6	White beans	<i>Phaseolus vulgaris</i>
7	Black sesame	<i>Sesamum indicum</i>
8	Horse gram	<i>Macrotyloma uniflorum</i>
9	Black gram	<i>Vigna mungo</i>

with two to three pieces of copra (coconut endosperm) and navadhanya, were spread sparsely in the shade at room temperature as drying under direct sunlight may degrade chemicals that are either heat or light sensitive. After the oblations had been dried, they were powdered in a household blender. Efforts were made to analyze all powdered samples within a period of 3 months.

A modification of the protocol of Alade and Irobi [8] was employed for the extraction. First, 100 g of the powdered sample, which contained equal amounts of all the chosen ingredients, was taken and soaked in 500 mL of 70% alcohol for 72 hours. After this treatment, the mixture was subjected to orbital shaking at room temperature for 72 hours. After 72 hours, the mixture was allowed to pass through Whatman filter paper No. 1 (Whatman, Maidstone, UK), and the filtrate was concentrated in vacuum. The resultant solution was stored at 4°C.

A PerkinElmer GC Clarus 500 system (PerkinElmer, Shelton, USA) with an AOC-20i autosampler and GC-MS equipped with an elite-5MS (5% diphenyl/95% dimethyl polysiloxane) fused to a capillary column (30 × 0.25 µm ID × 0.25 µm df) was used to obtain the GC-MS spectrum of the prepared extract. The electron ionization system was run in the electron impact mode with an ionization energy of 70 eV for GC-MS detection. Helium (99.99%) was the carrier gas, and the flow rate was maintained at 1 mL/min. The injection volume was adjusted to 2 µL. The temperatures of the injector and the ion source were maintained at 250°C and 200°C, respectively. The oven temperature was

programmed to maintain isothermal conditions for 4 minutes at 100°C, which was followed by an increase at a rate of 10°C/min to 300°C, ending with a 6-minute isothermal at 300°C. The total GC-MS running time was 30 minutes. The mass detector was a Turbo-Mass Gold-PerkinElmer system (PerkinElmer, Shelton, USA), and Turbo-Mass version 5.2 was used to study the mass spectra and the chromatograms.

3. Results

Although numerous peaks were observed in the GC chromatogram (Figure 2), an effort was made to analyze only the 17 dominant peaks (Figure S1; Table 2). Fumigation and fumigating substances play a vital role in realizing the benefits of agnihotra, as has been reported [9]. The process of fumigation is determined by the boiling point and the vapor pressure of the volatile substances/compounds involved [9,10]. The structure of the agnihotra pyramid has been reported to create a temperature gradient across it, i.e., the bottom of the pot may be at 300–400°C, and the portion just above the flame may be at 1200–1300°C [9]. When the flame becomes less intense, the upper limit of the temperature gradient limit may be 600–700°C and the lower limit may be 200–300°C [9]. This region can be termed as the “potential fumigation zone” (PFZ) because the most active and potent fumigation occurs in this region and the supply of air is limited [9]. The majority of hydrocarbons in the PFZ region undergo partial oxidation and give rise to the formation of various products because the autogenous ignition temperatures of most hydrocarbons are in the range of 500–600°C [9,11]. The products that are liberated during the performance of agnihotra yajna using modified ingredients are as follows: (1) in the PFZ, aromatic compounds of high boiling point and other oils vaporize and are liberated into the atmosphere; (2) from the bottom of the pyramid (colder regions), major compounds that are liberated are esters, borneol, and organic acids. Comprehensive analysis using other techniques may reveal the presence of compounds other than those listed in Table 2; (3) the esters listed in Table 2 have pleasing aromas that may influence the hypothalamic control of hormones and neurotransmitters by inducing certain responses via the olfactory system [12]; (4) the hydrocarbons identified in

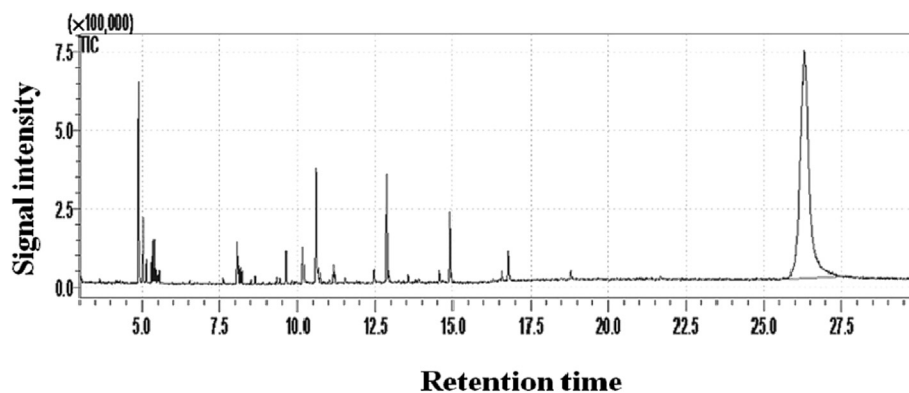


Figure 2 GC chromatogram of modified fire oblations used for agnihotra yajna.

Table 2 Identified major compounds in the agnihotra sample*.

Sl. No.	Name of the compounds	Retention time (Min)
1	Isoborneol (exo-2-hydroxy-1,7,7-trimethylnorbornane)	05.00
2	Borneol (endo-1,7,7-trimethyl-bicyclo[2.2.1]heptan-2-ol)	05.10
3	1-dodecene	05.30
4	Ethyl octanoate (caprylic acid ethyl ester)	05.35
5	n-tridecane	05.40
6	n-octanal (caprylic aldehyde)	05.50
7	Endo - isocamphonone	05.60
8	1-tetradecene	08.00
9	Ethyl decanoate (decanoic acid ethyl ester)	08.09
10	Hexadecane	08.15
11	Elemene	08.20
12	2,4-bis(tert-butyl)-phenol	09.60
13	Dodecanoic acid (lauric acid)	10.17
14	Ethyl dodecanoate (lauric acid ethyl ester)	10.60
15	Ethyl behenate (behenic acid ethyl ester)	12.80
16	1-hexadecanol	16.70
17	Lirioresinol beta-dimethyl ether (1H,3H-furo[3,4-c]furan, tetrahydro-1,4-bis(3,4,5-trimethoxyphenyl))	25.90

* Results (identification of compounds) are based on a similarity search in the GC-MS library.

Table 2 again undergo partial oxidation and produce methyl alcohol, ethyl alcohol, formaldehyde, acetaldehyde, and formic and acetic acids; and (5) all these volatile substances spread out into the surrounding atmosphere and are subjected to the photochemical reactions with sunlight and form various compounds [9], which may be the reason behind the strict instructions to perform agnihotra during daytime (sunlight is a major factor) [9,12].

As for the pharmacological properties of certain identified compounds and their implications for health management, the presence of essential oils (i.e., concentrated hydrophobic liquid containing volatile aromatic compounds from plants) was noticed (Table 2), and partial oxidation of various aromatic hydrocarbons certainly produces formaldehyde [13]. Formaldehyde is the most basic form of an antimicrobial aldehyde [14] and is known to be a reactive antimicrobial as it reacts with proteins and peptides in microorganisms and kills them [14]. While agnihotra is being performed, a small amount of formaldehyde, along with water vapor, is always produced [9]. Other higher aldehydes may not be as effective as antimicrobial agents such as formaldehyde.

In addition, when camphor, which is derived from the plant *Cinnamomum camphora* and is not a potent disinfectant, is used as a firing agent in agnihotra yajna, it masks foul smell and helps to clear the breathing systems of

people who inhale the fumes emanating from the agnihotra pyramid [12]. Thus, people experience an elevated feeling [12]. Moreover, aliphatic acids volatilized as a result of slow combustion enhance the germicidal action of smoke [15,16]. For instance, lauric acid is active against *Propionibacterium acnes*, an organism causing acne inflammation [17]. Furthermore, the volatilization of various fatty acid esters (Table 2), such as caprylic acid ethyl ester, decanoic acid ethyl ester, behenic acid ethyl ester, and lauric acid ethyl ester, may release organic acids into the smoke, thus enhancing the beneficial effects of the agnihotra smoke.

Other compounds identified in the flumes include lirioresinol beta-dimethyl ether, which was recently reported to have an inhibitory effect against breast cancer-mediated bone destruction by blocking the vicious cycle between cancer cells, osteoblasts, and osteoclasts [18], and elemene (β -elemene), which was reported to have antilung cancer activity and was found to reduce the side effects of chemotherapy [19]. In addition, the 2,4-bis (tert-butyl)-phenol identified in the present study has antioxidant [20] and anti-inflammatory effects [21] and has effective action against an agriculturally important fungus, *Fusarium oxysporum*, in inhibiting spore germination and hyphal growth [22]. This compound possesses unusual pharmacological actions [21]. The other compounds in Table 2 possess antimicrobial/germicidal actions of varying intensities.

In addition to the ingredients tested, cow ghee is another important traditional ingredient that is poured into the fire. The fumes that are liberated during the combustion of ghee help to protect the respiratory system and facilitate the removal of blood clots and bacterial infections in nasal passages, lungs, and veins [12]. Hence, daily exposure to this medicinal smoke should certainly have a favorable influence on the health of the mind and the body of the person inhaling the fume. In addition, the potent antimicrobial action of all the above identified compounds purifies the air in the place where agnihotra yajna is performed. Thus, the various health benefits that result from performing agnihotra yajna can be attributed to two sources of energy: medicinal smoke and PCE/Chi/Prana.

4. Discussion

In view of the fact that the human body is a form of energy, the discussion section is divided into four subsections. The first three sub-sections detail the concept of PCE/Chi/Prana, its relationship with the chakra system, and its effect on the entropy of the human body system. The last subsection discusses the two major aspects of agnihotra yajna, medicinal smoke and PCE/Chi/Prana.

4.1. Concept of PCE/Chi/Prana in health

According to Gabriel Cousens' [1] classic text "Spiritual Nutrition", nutrients represent different density levels of energy, and sunlight, which can be absorbed by the eyes and skin, is the least dense form of cosmic energy [1]. The "10-percent rule" in ecology [23–25] supports this point of view. According to this rule, when sunlight energy, the ultimate source of energy (100%) in nature, is absorbed by producers (autotrophs—first trophic level), only 10% of

energy is gained by them (90% is lost), and when these autotrophs are consumed by primary consumers, only 10% is gained by them [23–25]. Thus, as energy moves up the food chain, 90% of the energy is lost at each trophic level [23–25]. Thus, the food that we eat contains a minute fraction of the solar energy absorbed at the first trophic level. This information is of immense value because the human body can be considered to be a mass of energy vibrating at different frequencies [26]. Because our body is a form of energy, the food that we eat, the medicines that we take, and the water that we drink must be able to maintain a constant and continual energy flow within the human body and between it and its surroundings.

Though sunlight is the ultimate source of energy for human beings, PCE [1], which is life giving, exists. In the acupuncture system, it is known as Chi, and in the Indian Vedic system, it is termed as Prana. PCE/Chi/Prana was reported to be the unprecipitated form of cosmic energy and the primary, indispensable nutrient needed by us [1]. Solar energy can enter our bodies via the skin and eyes, whereas PCE/Chi/Prana cannot [1]. In fact, PCE/Chi/Prana was reported to enter the human body mainly through the seventh major energy center located at the top of the head (the crown, or Sahasrara, chakra) [1] and through breathing [27]. In this context, PCE/Chi/Prana must travel downward through all the remaining chakras to maintain a continual and constant energy flow. From chakras, PCE/Chi/Prana flows through meridians (acupuncture system) or nadis (Indian system). To exemplify further, chakras, meridians/nadis, and PCE/Chi/Prana are analogous to electrical substations, power lines, and electricity, respectively. The intake of a high quantum of PCE/Chi/Prana is a prerequisite for removing the energy blocks in meridian lines/nadis and acupuncture points [27]. Any imbalance in the alignment of the chakra system causes a resistance to the flow of PCE/Chi/Prana because such energy imbalances deprive the meridian lines/nadis and acupuncture points of energy. Therefore, though all of us receive PCE/Chi/Prana, the free downward flow of PCE determines the health of an individual as this flow is essential for supplying PCE/Chi/Prana to associated energy channels (meridians/nadis). Because nutrients represent different levels of precipitation of energy, for humans, the free flow of the unprecipitated form of cosmic energy, i.e., PCE/Chi/Prana, which is otherwise termed as the “primary nutrient” [1], is vital for healthy living.

As living beings, each of us needs to live in an environment that contains a high quantum of PCE/Chi/Prana so that the body can absorb it, thereby “balancing and aligning” the major energy centers in our bodies. However, the quantum of PCE/Chi/Prana varies from one geographical location to another [27]. For instance, in geopathic stress zones [28], the quantum of PCE/Chi/Prana would be significantly lesser than that in other unaffected areas. The geopathic stress zones are characterised by the continuous emission of energies (low-frequency electromagnetic waves) from the earth, which causes poor health [28]. This fact demands the development of appropriate strategies to increase the quantum of PCE/Chi/Prana in geographical locations where its level is very low, particularly, geopathic stress zones and highly polluted areas.

4.2. PCE/Chi/Prana in the field of human energy and health

Chakras are considered to be vital energy centers that play a pivotal role in balancing human health [29]. Chakras are reported to be centers of highly concentrated energy along the spinal cord and to be associated with the seven major endocrine glands in the body [30]. The spin of these chakras influences the functioning of various organs in the human body greatly, and generally, a clockwise spin is ascribed to balanced and aligned chakras [1]. In Eastern philosophy, seven energy zones/layers (corresponding to the chakras) close to the human body have been described. Similarly, an energy field close to the human body, i.e., a human energy field (aura), having three zones/layers was reported in the last century [31]. Aura or the human energy field was reportedly observed for the first time by Walter Kilner in 1911; when he observed a human body through glass screens stained with dicyanin dye [31,32], he could see a glowing mist of three layers around the human body [32]: a 0.25-inch layer nearest to the skin, a 1-inch-wide layer streaming perpendicularly from the body (more vaporous), and a delicate, exterior luminous layer with a 6-inch width and indefinite contours [31]. The intensities of these layers varied depending on the physical, mental, and emotional states of the person [31,32]. Any distortions in this human energy field caused discomfort and disorders [31]. Careful examination has revealed that the human aura is identical in characteristics to the seven energy layers contributed by the radiation emanating from the seven chakras [1]. Each chakra absorbs a particular color in the visible spectrum (VIBGYOR) [6,33] (Figure 1): red for the root chakra (bottom), orange for the sacral/spleen chakra, yellow for the solar plexus, green for the heart chakra, blue for the throat chakra, indigo for the brow chakra, and violet for the crown chakra (top).

In the visible spectrum, violet (red) has the shortest (longest) wavelength; therefore, it possesses the highest (lowest) frequency with highest (lowest) energy. A reasonable explanation for this phenomenon is that when sunlight hits the human aura, the visible spectrum of sunlight is divided into seven colors that then enter the body through the skin and eyes [1]. Thus, the rays separated are directed to each of the corresponding chakras to assign an energy level in descending order to maintain a constant and continual flow of PCE/Chi/Prana through the chakra system from a higher energy to a lower energy state. Similarly, PCE/Chi/Prana enters through the crown chakra (region of maximum energy) and flows through subsequent chakras to reach the root chakra (region of minimum energy). However, in geopathic stress zones or highly polluted locations, the aforementioned flow may not be optimized because in such regions, the quantum of PCE/Chi/Prana would be very low; thus, diseases may occur. In geopathic stress zones, the poor-health-creating energies emanating from the earth [28] disrupt the “oscillatory equilibrium” [34] of the human body due to the resonance effect, and the amount of PCE/Chi/Prana available in such areas is not sufficient to shift from a state of “oscillatory disequilibrium” to “oscillatory equilibrium”. Thus, in such regions, tools/strategies to increase the quantum of PCE/Chi/Prana are needed.

4.3. Effect of PCE/Chi/Prana on entropy and the human body

According to the second law of thermodynamics, the universe always tends toward increasing entropy, which denotes randomness or disorder. The entropy of the human cellular system must be very low in order to realize health, i.e., oscillatory equilibrium [34]. Because cells and cellular components are known to vibrate at certain frequencies, any disruption would lead to potential regulatory issues [35]. In the human body, biological macromolecules, such as DNA, proteins, and carbohydrates, are composed of large numbers of atoms in close proximity in a regular pattern. In such systems, single valence electrons form a common band [36]. The products of DNA expression, i.e., proteins, are reported to be semiconductors that can transfer this band of free electrons from one site to another within the human body [36,37]. This charge transfer is vital for the body to function properly. In this context, if the body's entropy is increased by any means, potential irregularities may occur in the vibrational dynamics of the cells and intracellular structures. This disruption will adversely affect the charge transfer necessary for the flow of biological information.

According to Standard Acupuncture Nomenclature given by the World Health Organization [38], 400 acupuncture points and 20 meridian lines connecting most of those points have been documented [29]. Various scientific investigations have proven that most acupuncture points and meridians are areas of high electrical conductance on the surface of the human body [29,39–43]. Most acupuncture points have also been proven to host a 12-fold higher density of gap junctions (hexagonal protein complexes that facilitate cell-to-cell communication and have electrical conductivity) [29]. This grouping of gap junctions at the acupuncture points supports the aforementioned Szent-Gyorgyi's finding that complex protein structures transfer bands of free electrons from one site to another for effective cell-to-cell communication [36,37]. This communication via gap junctions has also been reported to be vital for morphogenesis [44]. An increase in entropy would certainly cause high levels of fluctuations in the passage of information from cell to cell. Recently, the metastatic cancer phenotype was found to be characterized by an increase in the entropy of the local information flux patterns [45]. Another discovery was that measures of local entropy in integrated protein networks might be useful for identifying targets in cancer metastasis [45].

My proposal is that people who live in geopathic stress zones or highly polluted areas experience an increase in entropy because of an "oscillatory disequilibrium" [34] caused by the resonance effect. A thorough analysis of various yajnas performed during ancient civilizations in India revealed that the ultimate aim of all fire ritual processes was to decrease the entropy of the human body by increasing the intake of PCE/Chi/Prana. This is supported by an interesting finding, based on an electrophotonic imaging technique, that a reduction in entropy is always associated with participation in bhaishajya maha yajna [46] due to an increase in the quantum of PCE/Chi/Prana during the performance of yajna [47]. The intake of adequate quanta of PCE/Chi/Prana always minimizes the entropy.

4.4. Medicinal smoke and PCE/Chi/Prana: two major aspects of agnihotra yajna

Our brain cells communicate with one another by utilizing electric charges. This electrical activity in the brain is generally known as the brainwave pattern. The human brain exhibits different kinds of brain waves: delta waves (0.5–3 Hz), theta waves (3–8 Hz), slow alpha waves (8–12 Hz), fast alpha waves (12–15 Hz), beta waves (15–25 Hz) [48], and gamma waves (38–42 Hz) [49]. These waves represent the ladder of consciousness. In the brain of a spiritually-enlightened person, gamma waves will be abundant; however, if a person has no deep consciousness, the gamma waves will not be present [50]. The gamma waves have the highest frequency (highest energy) among brain waves. My hypothesis is that incessant flow of PCE/Chi/Prana through the chakra system without any blockage generates sufficient wave activity, from alpha to gamma waves, in the brain to maintain good health.

The pyramid used for the agnihotra yajna resembles the temple ponds in India, i.e., "Kalyani". The purpose of constructing a Kalyani in ancient temples was to cleanse the human body and mind prior to darsan in temples in order to allow the person to receive the divine energy coming from the sanctum sanctorum. From this, my belief is that the shape of the pyramid used in agnihotra (section of an inverted pyramid having a flat bottom) and that of the temple pond, Kalyani, allow PCE/Chi/Prana to be attracted and disseminated to the surroundings more effectively. A recent study found that the subtilization of matter into energy occurred during the performance of agnihotra yajna in the form of transformations of specific ingredients from a solid state to either a vapor phase or a colloidal phase, and as a result, electromagnetic waves were generated. These electromagnetic waves, together with the chanting of specific Vedic hymns (unique sonic signals), have potential health benefits [12]. The combustion of offerings in the agnihotra pyramid is thought to increase the PCE/Chi/Prana in the surrounding atmosphere [47], and the intake of this increased quantum of PCE/Chi/Prana by breathing is thought to optimize the alignment of chakras and would certainly establish energy connections between the physical body and the electromagnetic body via the chakra system [28].

The increase in the quantum of PCE/Chi/Prana by employing the agnihotra pyramid occurs only in the presence of the fire element. As for medicinal smoke, the routine practice of agnihotra yajna maintains the threshold values of potential therapeutic compounds in the human body [12], which, in turn, enhances the immunity to a great extent. For instance, the *Cocos nucifera* and the *Sesamum indicum* used in the present study were reported to be potentially useful in scavenging free radicals, thus preventing the pathogenesis of diseases [12,51]. In addition, I postulate that the vibrations generated in the pyramid during the process of agnihotra will be absorbed by the bone structure, which is the single major solid crystalline structure in the body, and will later be amplified and transduced as biological signals necessary for the proper functioning of the human body [1].

Moreover, the increased levels of antioxidants in the fumes reach the brain and then the nerves, thus alleviating

psychological depression [12]. Also, the distinct energy currents emerging from all Vedic fire rituals have been reported to possess curative actions for diseases, such as headaches, migraines, mental dullness, intellectual deficiencies, depression, insomnia, intemperance, epilepsy, schizophrenia, and varieties of manias [12,52]. It is commonly known that the therapeutic value of a yajna is determined by the ingredients used [12]. Therefore, logically, the efficacy of agnihotra yajna can be increased drastically by incorporating suitable natural elements, and such a provision is given in an ancient Vedic text, Jaiminiya Brahmana 1:19 [53].

In light of all the above facts, agnihotra yajna can be considered as a complementary medicine that removes the energy blocks in the meridians/nadis. In conclusion, the ultimate purpose of practicing agnihotra yajna is to realize "LIFE", which means "letting incessant flow of energy" through our body–mind system as any blockage in this flow would cause disharmony and chaos in the system, thus leading to poor health.

Disclosure statement

The author has no conflicts of interest and no financial interests related to the material in this manuscript.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.jams.2016.11.002>.

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AGNIHOTRA – A Non Conventional Solution to Air Pollution

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Abstract - The present study entitled “Agnihotra-A Non conventional solution to air pollution” is completely based on laboratory work. Our main aim was to find out non conventional solution to air pollution by criteria pollutants like SO_x, NO_x, CO, RSPM, and SPM. We used very innovative ideas to reduce the concentration of criteria pollutants using Agnihotra. In this experimental work we have achieved a good level of treatment. We conducted yagya, using all the procedure guided by literature of Pandit Shri Ram Sharma Acharya, in laboratory and artificially generated pollution conditions. After taking 5-10 readings and studying all the different methodologies, using almost 324 Ahuties yagya with clarified cow butter (ghee), Pipal wood (*Ficus religiosa*), Havan samagri (kapurkachari, gugal, nagarmotha, balchhaar or jatamansi, narkachura, sugandhbela, illayachi, jayphal, cloves and dalcini etc.), we came across a conclusion that the air pollution of criteria pollutants can be effectively reduced opting column method using locally available materials and without adding any chemicals. Under the natural lab conditions and after creating local and artificial indoor air pollution it was noticed that Sox, Nox were considerably reduced by almost 51%, 60% respectively more by yagya when compared without yagya and both RSPM & SPM were also found to be reduced by 9% & 65% respectively more as compared to the condition without yagya. Although the RSPM & SPM concentrations were still there but not to the extent of unhygienic conditions. The odor and smell of the Havan hall was not at all objectionable.

Key words: Yagya, Agnihotra, Acharya, Havan Samagri, Pandit, Aahuty. RSPM, SPM.

I. INTRODUCTION

Atmospheric pollution is considered to be most dangerous pollutant of our ecosystem as it has direct influence over all living and nonliving things and its control by isolation and then cleaning becomes beyond man's effort unless the pollutants are controlled at the source itself. A diverse variety of pollutants are emitted into the atmosphere by both natural, anthropogenic and industrial activities sources.

Today we are bound to breathe in harmful gases like NO₂, CO, SPM and RSPM, which are all beyond the limits prescribed by the various Environmental Agencies and are extremely harmful for human health. The Government is spending billions of Rupees to tackle such problems but not very effectively positive results are being seen. So an effective, long lasting and non-conventional solution for this air pollution problem, the Vedic Science of 'Yagya' was chosen for the necessary experimentation to see if it actually helped in the reduction of air pollution as mentioned in the ancient books. By burning several types of wood and as per digital analog records of CO emission, the mango wood was found with almost near zero CO emission and that's why its Samidhas were used for the experiment. The special Havan Samigri prescribed by Brahma Varchas, for the purification of atmosphere, was used along with the normal havan samigri and Cow's pure ghee for the Havan.

In all the experiments, the effect of Yagya was studied on the atmospheric odour, on the air microflora and also on the gaseous pollutants like NO₂, SO₂ and RSPM. The effect of odour was very good as after Yagya, the nice smelling odor lingered on till the evening and a very faint smell remained till the next day (in the indoor experiments).

To study the impact of Yagya on air microflora, several indoor experiments were conducted, to compare the effect of Yagya and that of non-Yagya. The results were very encouraging. In all the indoor experiments there was a significant reduction in the microbes especially the pathogens. The decrease on the day 3 in the four experiments has been recorded as 100%, 67%, 87% and 93% respectively in pathogens, which is impressive and supportive of the fact

that Yagya renders the atmosphere bacteriostatic and it kills the harmful microbes in the atmosphere. (Central Pollution Control Board, Delhi.)

One experiment was continued till 7 days after Yagya resulting an impressive reduction of 93%, in bacteria, 88% in fungi and 93% in pathogen, as compared to their respective backgrounds showing the effect of Yagya is long lasting and it continues till long after the physical process has occurred. It is the general belief that any type of fumes help in the reduction of air microbes. In the experiments of comparison of Yagya with that of non- Yagya, proper Yagya was performed at one place and plain wood was burnt at another place keeping factors like temperature, humidity, number of persons, air flow etc., as constant and samples of air were taken before Yagya, during Yagya and till two days after Yagya. The results were very surprising. In the case of Yagya where there was a reduction of 79%, 68% , 69% and 33 % respectively as compared to the background in the bacteria, fungi, TMF and the pathogens till two days after the Yagya there was an increase of 111%, 257%, 104% and 100% respectively as compared to the background, one day after the Non-Yagya experiment. The same experiment was repeated again after one year and the results of this experiment were again similar. In fact the fumigation of simple wood has led to an increase in the counts in most of the cases. Whereas on the other hand the smoke/ gases produced as a result of Yagya led to an overall decrease in the Air microflora in the atmosphere.

Another study was conducted in the open air at a place called Karawal Nagar in East Delhi where a large scale Yagya of 108 Kunds was performed. The sampling was done in the same way as in the case of indoor experiments and a comparison of the microbe colony counts during and after Yagya was made with the background . The experiment continued from 12th to 16th of Yagya and the sampling was continued till two days after the Yagya. The results show that in comparison with the background counts, there was a reduction of 55% in bacteria, 15% in fungi, and 79% in the pathogens on the next day after the Yagya was over. The reduction in pathogens was 79% even on the second day after Yagya. The total micro flora had reduced by 49% on the 2nd day after Yagya. (Experiments conducted under Central Pollution Control Board, Delhi.)

In order to study the effect of Yagya on the gaseous pollutants, two experiments were performed in the open air. Samples of air were collected by CPCB in one case and by Envirotech in the second case and analyzed for gaseous pollutants SO₂ and NO₂ . The two experiments were performed at M.S.Apartments, K.G. Marg, New Delhi, in the open air in January 2004 and February 2005, respectively. In both the experiments the objective was to see if there was any effect of performing Yagya in the open air on the gaseous pollutants. The results in both the cases were encouraging. In the first experiment there was a reduction of 47% in NO₂ on the day of Yagya and 60% on the next day. In case of SO₂, the reduction was 86% on the day of experiment and almost 100% on the next day as the SO₂ was below detection level.

Similarly in the second open air experiment the NO₂ reduced by 23% on the day of experiment and was 25% reduced on the next day after Yagya. SO₂ was 33% below the background level on the day of Yagya and was 41% reduced on the 2nd day after Yagya. In both the above experiments there has been perceptible change in the quantum of NO₂ and SO₂, as compared to the background. (Experiments conducted under Central Pollution Control Board, Delhi.)

All the above findings are indicative of the fact that the process of Yagya is effective in the reduction of air pollution both gaseous and microbial and also removes the bad odour, if any, at the place. It is also seen that the effect of Yagya remains in the atmosphere for days after it has actually been performed. Hence we see that ‘Yagya’ is probably the only possible solution for today’s environmental pollution problems.

The importance of this Yagya was known to our ancestors who recommended that Yagya should be performed by every person and in every home on daily basis. Today we have forgotten this science and it is time that we should revive this ritual and adopt it for the betterment of ourselves and our future generations. (Agnihotraindia.com)

A. Air Pollution

Air pollution includes a diverse array of natural and anthropogenic emissions, gaseous constituents, volatile chemicals, aerosols and their atmospheric reaction products. Ambient air is an atmospheric sink, where all above emissions are released. Many such emissions in small quantities get immediately dissipated and absorbed but continuous release of these pollutants pose hazards to human health. Despite many pollution control efforts, the air quality is going deteriorated to alarming levels in several cities throughout the world. The World Health Organization (WHO) estimates that as many as 1.4 billion urban residents in the world breathe air exceeding the WHO air quality guidelines (World Resource Institute, 2000). The health consequences of exposure to dirty air are considerable. On a global basis, estimates of mortality due to outdoor air pollution is estimated to be around 2.0 to 5.7 lacs, representing about 0.4 to 1.1 percent of total annual deaths. The severe adverse effects of air pollution are more pronounced in the

developing countries like India. On the one hand, the developing countries are grappling with the environmental problems associated with inadequate economic developments, the hallmarks of which are malnutrition, poor sanitation and lack of basic human needs. On the other hand, in their pursuit for rapid economic development, the developing countries are confronted with a newer set of environmental problems due to increasing air pollution on account of industrialization, urbanization and motorization.

Severe air pollution episodes during last century have shown that breathing dirty air can be dangerous and at times deadly. The 1948 'Killer Fog' in small town of Donora, Pennsylvania that killed 50 and the particularly virulent 'London Fog' of 1952, in which some 4000 died, were associated with widespread use of dirty polluting fuels. Since then, many countries have adopted ambient air quality standards to safeguard the public against the most common and damaging pollutants, which include sulphur dioxide, suspended particulate matter, ground level ozone, nitrogen dioxide, carbon monoxide and lead, which are directly or indirectly released by the combustion of fossil fuels. Although substantial investments in pollution control in some countries have lowered the levels of these pollutants in many cities, poor air quality is still a major concern throughout the industrialized world.

B. Indoor Air Pollution

Combustion, building material, the ground under the building and biological agents are the four major principal sources of indoor air pollutants. Indoor air pollutants can pose even a greater health risk and hence is a concern where energy efficiency improvements sometimes make the house relatively air tight thereby reducing ventilation and raising indoor pollutant levels. Indoor air pollution is usually associated with occupational situation particularly through combustion of biomass fuels. Traditional fuels for cooking and heating produces large amounts of smoke and other air pollutants in the confined space of home, a perfect recipe for high exposures. Liquid and gaseous fuels such as kerosene and bottled gas although not completely pollution free but many times less polluting than unprocessed solid fuels. In these circumstances, exposure to pollutants is often far higher indoors than outdoors.

The health problems due to indoor air pollutants are more widespread than those caused by outdoor air pollutants for the following reasons.

- The exposed persons are in close proximity to the source of indoor air pollutants.
- A recent report of WHO asserts 'the rule of 1000' which states that a pollutant released indoor is one thousand times more likely to reach the lungs than a pollutant released outdoors.
- Women and children, particularly those in rural sector spend more time indoors than outdoors.
- In rural areas, indoor air pollution is responsible for much greater mortality than ambient air pollution.

Epidemiological studies have linked exposure to indoor air pollution from dirty fuels with at least four major categories of illness:

- Acute respiratory infections (ARI) in children
- Chronic Obstructive Pulmonary Disease (COPD) such as asthma and bronchitis;
- Lung cancer and
- Pregnancy related problems. Of these, ARI appears to have the greatest health impact in terms of the number of people affected.

Almost 80% of domestic energy consumption in our country is traditional biomass fuels. When these fuels burn in simple cook stoves during meal preparation, air inside homes get heavily polluted with smoke that contains large amounts of toxic pollutants such as carbon monoxide, oxides of nitrogen (NO_x), sulphur dioxide (SO₂), aldehydes, dioxins, polycyclic aromatic hydrocarbons and respirable particulate matter. The resulting human exposures exceed the permissible norms.

II. KEY FINDINGS OF INDOOR AIR POLLUTION STUDIES (ESMAP, World Bank 2000)

Exposure to biomass smoke increases the risk of acute respiratory infection (chest infection, coughs, colds and middle ear infections). Children in the Gambia Island found riding on their mother's back, during cooking over smoky stoves were more likely to develop Acute Respiratory Infection (ARI) than unexposed children.

A study in Tanzania reported that the children below five years age died of ARI, were more likely to sleep in a room with an open cook stove than healthy children in the same age group.

Studies in India and Nepal show those non-smoking women who have cooked on biomass stoves exhibit a higher prevalence of chronic lung disease (asthma and chronic bronchitis). The incidence of moderate and severe ailments among two year olds, increased as they spent greater hours near the fire.

Exposure to high indoor smoke levels is associated with pregnancy related problems such as still births and low birth weights. One study in Western India found a 50% increase in stillbirths in women exposed to indoor smoke during pregnancy. Considerable amount of carbon monoxide has been detected in the blood stream of women cooking with biomass.

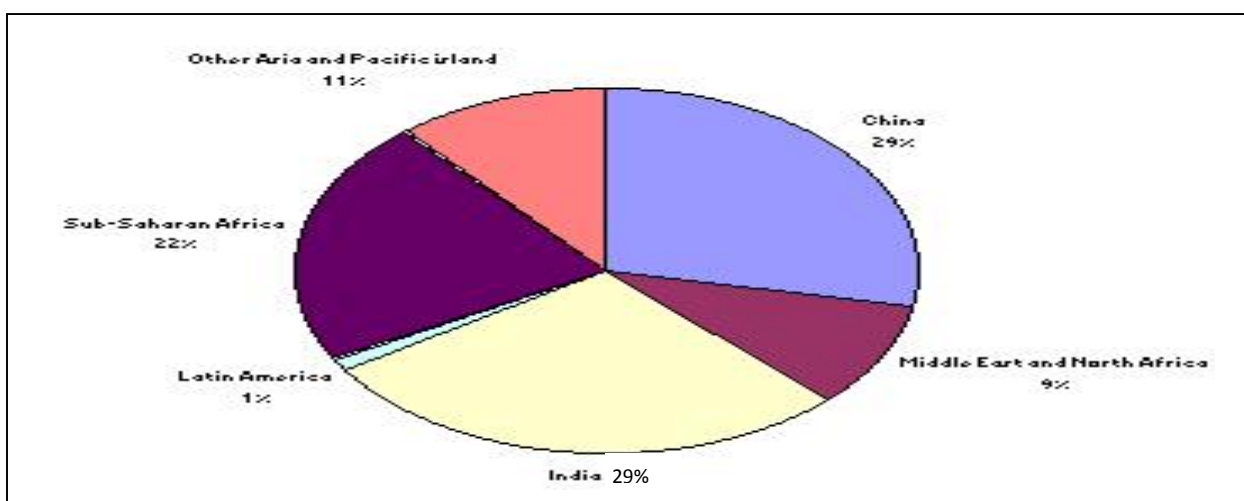
- Other than these four major categories of illness; indoor air pollution is associated with blindness and changes in the immune system. Eighteen percent of blindness may be attributed to the use of biomass fuels.

Further, a 1995 study in Eastern India found the immune system of new born to be depressed due to the presence of indoor air pollution.

1. Annual deaths due to Air Pollution in Urban and Rural areas

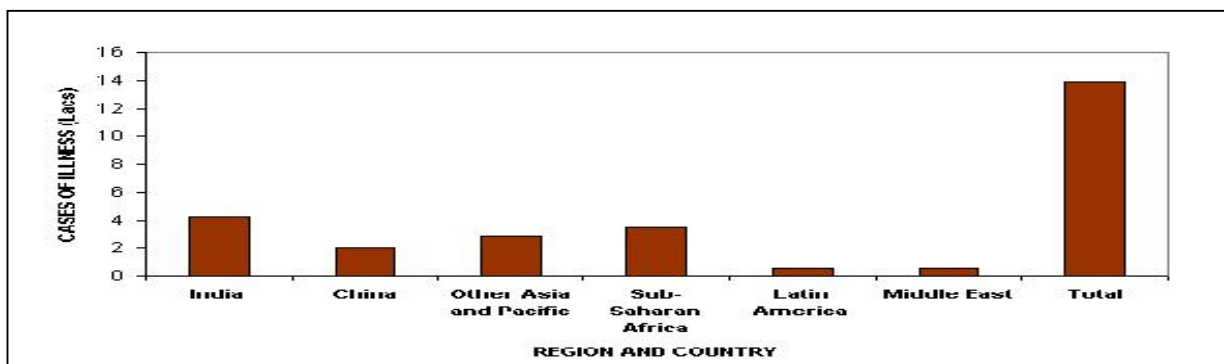
Region	Urban Outdoors	Urban Indoors	Rural Indoors	Total
Developed Countries	14 (0.5)	252 (8.4)	28 (0.9)	294 (9.8)
Developing Countries	186 (6.2)	644 (21.5)	1876 (62.5)	2706 (90.2)
Total	200 (6.7)	896 (29.9)	1904 (63.5)	3000 (100)

Source: Report of the Committee on Environment and Health (MoEF), May 2000



• Figure 1 Deaths due to Indoor Air Pollution in the Developing World

Source: Indoor Air Quality, ESMAP, World Bank, September 2000



Source: Indoor Air Quality, ESMAP, World Bank, 2000

Six Common Air Pollutants

The Air Prevention and Control of Pollution Act, 1981 requires MoEF to set National Ambient Air Quality Standards for six common air pollutants known as "criteria pollutants" found all across the country. These are

particulate matter, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides and lead which can harm our health and the environment, and cause property damage. Of the six pollutants, particle pollution and ground-level ozone are the most widespread health threats. EPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria for setting permissible levels. The set of limits based on human health is called primary standards. Another set of limits intended to prevent environmental and property damage is called secondary standards.

Table-2. Summary of Health Effects of Basic Air Pollutants:

Pollutant	Health Effects
Carbon Monoxide	Poor reflexes, Ringing in the ears, Headache, Dizziness, Nausea, Breathing Difficulties, Drowsiness, Reduced work capacity, Comatose state (can lead to death)
Lead (Pb)	Kidney Damage, Reproductive system damage, Nervous system damage (including brain dysfunction and altered neurophysical behaviours)
Oxides of Nitrogen (NOX)	Increased risk of viral infections, Lung irritation (including pulmonary fibrosis and emphysema), Higher respiratory illness rates, Airway resistance, Chest tightness and discomfort, Eye burning, Headache
Ozone (O3)	Respiratory system damage (lung damage from free radicals), Reduces mental activity, Damage to cell lining (especially in nasal passage), Reduces effectiveness of the immune system, Headache, Eye irritation, Chest discomfort, Breathing difficulties, Chronic lung diseases (including asthma and emphysema), Nausea
Sulphur dioxide (SO2)	Aggravates heart and lung diseases, Increases the risk for respiratory illness (including chronic bronchitis, asthma, pulmonary emphysema), Cancer (may not show for decades after exposure)
Respirable Particulate Matter (PM10)	Respiratory illness (including chronic bronchitis, increased asthma attacks, pulmonary emphysema), Aggravates heart disease

Source (central pollution control board Delhi)

Indian Sub-Continental scenario of Air Pollution

Air pollution in India is caused by similar sources as that of China like urban growth, auto emissions, etc., with the exception that coal fired power plants contribute a smaller percentage of air pollution. In contrast to China, it has been researched that the burning of biofuels, such as wood, agricultural waste, and dried animal manure in cooking stoves, is the largest source of black carbon emissions in India contributing almost 42% of the total (Venkataraman, et al., 2005).

It is common to see dense haze in northern India and Bangladesh during the winter. The haze lingers near the base of the mountains because of temperature inversions. During the winter cold air flows down the mountains to the plains making the air near the ground cooler than the air above it. This traps pollution from agricultural fires and cities near the ground. (February 3, 2006, MODIS/Terra image courtesy of NASA)

Selected Location of Agnihotra:

Hindustan College Of science and Technology, NH-2, Farah, Mathura U.P., India, which is situated at a distance of 28 km from Mathura.

III. MATERIALS AND METHODS

Agnihotra: A brief introduction

Gayatri and Yagya are the pillars of Indian philosophy and culture. Gayatri Mantra, the eternal source of universal knowledge is deciphered and the cosmic energy of sound contained in it is activated and expanded with the help of Yagya.

The four Vedas reveal the philosophy of the eternity and absolute complementary role of Gayatri and Yagya in the divine creation. Atharvaveda deals with sound therapy aspects of mantras for the treatment of the ailing human system at the physical, psychological and spiritual levels. The Samaveda focuses on the musical chanting patterns of the mantras and the subtle form of Yagya by defining the latter as the process of mental oblation on the surface of internal emotions through the cosmic radiation of the omnipresent subtle energy of sound. The Yajurveda emphasizes the knowledge of principles and methods of performing Yagya as Spiritual and Scientific experiments for global welfare.

As a matter of fact Yagya is the selfless sacrifice for noble purposes. Sacrificing of the ego, selfishness and material attachments and adopting rational thinking, humane compassion and dedicated creativity for the welfare of all is indeed the best Yagya which should be performed by all human beings. The philosophy of Yagya teaches an art of living in the society in harmony, a living style to promote and protect higher human values in the society which is actually the basis of the ideal human culture.

The seva yagya, the service of the society is a noble example of Yagya. The Gnana Yagya, shows the service of people by enlightening their lives in the glow of knowledge and education. The Prana Yagya reveals the service of saving the lives of people from suffering and agonies and inspiring liveliness and respect for life in them. A variety of such Yagya are described in the Shastras. In physical terms, Yagya is a process aimed at the refinement of the subtle energy existing in matter with the help of thermal energy of the mantras. The knowledge of philosophy and science of Yagya is as essential for understanding and experimenting the science of spirituality as the knowledge of elementary physics is for material based sciences. The experiments of Yagya, when performed at a small scale in day to day life are called Havan or Agnihotra.

Scientific Aspects

There are two basic energy systems in the physical world: Heat and Sound. In performing Yagna, these two energies, namely, the heat from Yagna's fire and the sound of the Gayatri and other Mantras, are combined to achieve the desired physical, psychological and spiritual benefits. The fumigation of specific substances in the Yagna --- fire is a scientific method of subtilisation of matter into energy and expanding its potential and positive effects in the surrounding atmosphere. The electromagnetic waves generated thereby help in transmitting, at cosmic level, the desired sonic signals 'stored' in the Mantras, which are chanted during the process of sacrificing the special materials in the fire.

The various fumigating substances offered in Yagya are:

Wood:

Wood has to be small sticks of varying lengths called Samidhas according to the size of Agnikunda, dry and free from dust, insects and worms. The principal types of wood used are as, Sandal-wood (Santalum Album), Agar and Tagar wood (Aquilaria Malaccensis and Valeriana Wallichii), Deodar (Cedrus Libani), Mango (Mangifera Indica), Dhak or Palash (Butea Frondosa), Bilva (Aegle Marmelos), Pipal (Ficus Religiosa), Bargad (Ficus Bengalensis), Shami (Prosopis Spicigera), Gular (Ficus Glomerata). In addition to wood, various Havishya or Havan samagri are offered in Yagya can be divided into the following four groups of substances like,

Odoriferous: saffron, musk, agar, tagar, chandan, illaychi, jayphal, javitri and camphor.

Health Constituents: clarified butter (ghee), milk, fruits and cereals like wheat, rice, barley, til, kangu, munga, chana, arhar, masur or peas.

Sweet: sugar, dried grapes, honey or chuhara.

Medicinal Herbs: Somalata or Giloya, Brahmi, Shankhpushpi, Nagkesar, Mulhati, Red Chandan, Baheda, Sonth and Harad. Now-a-days Havan samagri is readily available in the market consisting of the following substances in a crude powder form. Saw dust of sandal-wood and pine wood, the agar and tagar wood chips, kapurkachari, gugal, nagarmotha, balchhaar or jatamansi, narkachura, sugandhala, illayachi, jayphal, cloves and dalchini.

Combustion products:

It is very difficult to interpret the process of combustion in a Yagya in a physical scientific terms due to: varying properties of substances used, unspecified conditions of combustion i.e. products of combustion depend on the following factors like nature of substances used and their proportions, temperature attained, air supply control and interaction amongst the various products formed etc.

Vaporization of wood:

Besides complete combustion of cellulose of wood, it is also subjected to vaporization. This occurs due to the Samidhas arranged in the Agnikunda, the conditions of temperature and air supply which prevail in it.

Odorous Substances Steam Volatilization

The temperature in Agnihotra varies in the range 250°C - 600°C, while in actual flames it can go as high as 1200°C to 1300°C. The boiling points of volatile constituents get diffused over in the surrounding atmosphere. Also when cellulose and other carbohydrates undergo combustion, steam is formed in copious quantities by the combination of hydrogen of organic substances with the oxygen. This is how the substances like thymol, eugenol, pinene, terpinol etc., are spread in the surroundings and the aroma of a Yagya is smelt even at considerable distances.

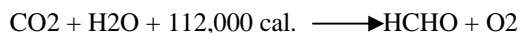
Along with steam, smoke is also given out in large quantities and solid particles existing in a highly divided state offer sufficient surface for mechanical diffusion. Thus smoke also functions as colloidal particles for diffusion of volatile aromatic substances depending on temperature and direction of the wind.

Fatty Substances Combustion:

The fatty substances used in Yagya are mainly ghee and other of vegetable origin. Ghee helps in rapid combustion of cellulose of wood and keeps the fire alight. All fatty substances used are combinations of fatty acids, which volatilise easily. The combustion of glycerol portion gives acetone bodies, pyruvic aldehyde and glyoxal etc. The hydrocarbons produced in the reactions again undergo slow combustion and as a result methyl and ethyl alcohols, formaldehyde, acetaldehyde, formic acid and acetic acids are resulted.

Photo-Chemical reaction

All the volatile substances diffused in the surrounding atmosphere undergo the photochemical reactions in the sunlight that is why it is recommended that Yagya to be performed in the presence of sunlight. These changes occur in the ultra-violet and other short wavelength regions. The products of fumigation thus go photochemical decomposition, oxidation and reduction. To some extent even CO₂ is also reduced to formaldehyde as follows:



From environmental angle, reduction of CO₂ produced in Yagya as above and liberation of oxygen cannot be overemphasized.

Inverted Pyramid Shaped Agni Kunda:

The word 'pyramid' means the fire in the middle'. The inverted pyramid shape of the Havan Kund allows controlled generation and multidirectional dissipation of energy. It acts as a generator of unusual energy fields and spreads them in its surrounding atmosphere.

For a daily Agnihotra (Balivaishva) a small copper pot is used. The inverted pyramid shaped Agnihotra pot receives, generates and decentralizes electrosphere. It acts as an effective bacteriostatic and antimicrobial reactor. Copper is universally acknowledged for its excellent conduction of electricity and heat.



The Agnihotra has an obvious link with fire, heat, electro-magnetic force and because of its inverted pyramid shaped Kunda, it does have connection with the cosmic energy fields. The dimensions of the copper pot used for the daily Agnihotras are: 14.5 cm×14.5cm at the top. 5.25cm×5.25 cm at the bottom and 6.5 cm in height with three steps. For large scale Yagyas, the dimensions are increased proportionately and the Kundas are also made up of specific combinations of clays. A part from the pyramid shape, some other special symmetric geometrical designs are also used according to the kind of energy fields and the cosmic currents required to be generated by the Yagya. Specific types of Kundas are recommended for different kinds of Yagyas.

Chanting Sanskrit Mantras:

The power of sound vibrations penetrates the energy spheres at the subtle and cosmic levels. All the alphabets of the Sanskrit language are endowed with special vibrational powers, which set out harmonious wave patterns when pronounced up to the mark. Dr. Howard Steingull, an American Scientist has established that recitation of Gayatri Mantra produces 110,000 sound waves per second. In fact recitation of the Gayatri Mantra during the fireworship (Yagya) acts supplementary. The patterns of chanting of Mantras are so designed that they latently contain the essence of the music or the quite essential sound of the torrent of life sustaining energies emanating from the cosmic energy centre of the corresponding Mantras. Uttering of these Mantras produce vibrations soothing to human mind, all plant and animal life. These vibrations also spread specific energy waves in the surrounding atmosphere as the oblations are offered.

Environmental Purification by Agnihotra

The ecological imbalance caused by the industrial wastes, rapid urbanization, deforestation, air and water pollution, ozone layer depletion, radioactive waves etc., acts of ‘civilized men’ have resulted into disastrous threat not only to human survival but to the life as a whole on our planet. Till recently it was accepted that research into science can furnish answer to all of man’s problems. Today we find increasing number of diseases including malfunctioning of body organs due to increasing severity of pollution in the atmosphere. Ozone layer depletion has been causing ailments like sunburn, skin cancer, cataracts and weakening of the immune system. Viruses are becoming drug-resistant and showing consistent growth trends.

Experimental studies reveal that the incidence of physical ailments, sickness and disease are reduced in the houses, where the Agnihotra is regularly performed because it creates a pure, nutritional and medicinal atmosphere. It renews the brain cells, revitalizes the skin, purifies blood and prevents growth of pathogenic organisms. Agnihotra is basically a healing process. ‘Heal the atmosphere and the healed atmosphere will heal you’ is the Modus Operandi . Purification of environment through the constituent electrons of the substances fumigated in the Yagya is an well proved effect of this process .

Dr. Hafkine mentioned “mixing ghee and sugar and burning them creates smoke which kills the germs of certain diseases and secretion takes place from some glands relate to the wind-pipe, which fill our heart and mind with pleasure”.

“Sugars present in Havishya have great power to purify the atmosphere. It kills the germs of T.B., measles, smallpox and cow-pox remarks” Prof. Tilward.

According to Dr. Shirowich,

- (i) Cow’s milk contains great power of protection from atomic radiation;
- (ii) Houses having cow-dung covered floors enjoy complete protection from atomic radiation;
- (iii) If cow’s ghee is put into Yagya fire, its fumes reduce the effect of atomic radiation to a great extent.

The medicinal fumes emanating from Agnihotra have been observed by researchers in the field of microbiology to be clearly bacteriolethal in nature. These eradicate bacteria and other micro-organisms, which are the root cause of illness and diseases. This must be the reason why the incidence of physical ailments, sickness and diseases becomes less in the households, where Agnihotra is regularly performed.

Even without going into detailed chemical bacteriology, it can be stated that performance of Yagya leads to purification of air. This takes place in the following four ways [2]:

Foul Odor Removal:

As already stated, under steam volatilization, the various volatile oils get diffused in the surrounding atmosphere along with steam and smoke. Since these oils have distinct good smell, the foul odors are automatically replaced. This aroma can be experienced easily in the surroundings when Yagna is performed due to diffusion of substances like thymol, eugenol, pine, terpinol and oils of sandal-wood, camphor and clove.

Bacterial Removal:

As stated under products of combustion, the partial oxidation of hydrocarbons and decomposition of complex organic substances produce formaldehyde which is a powerful antiseptic. It is also interesting to note that germicidal action of formaldehyde is only effective in the presence of water vapour which is also produced in large quantities in Yagna. The use of formaldehyde spray for disinfecting of walls, ceiling etc., is common and such a spray is automatically produced when Yagna is performed. The oxidation of hydrocarbons also produces formic acid and acetic acid both of which are good disinfectants. Use of formic acid for preservation of fruits and that of acetic acid in preserving vinegar is a common practice. The antiseptic and antibiotic effects of fumes of Yagna have also been examined by conducting suitable experiments on rabbits and mice and it has been established that fumes emitted in Yagna are powerful antibiotic. Agnihotra ash purifies and cleanses the water making it fit for drinking [5].

Insects Removal:

There are non-bacterial parasites like flies, ringworm, lice, fleas etc., which are immune to bactericides, which are also harmful to other living beings. Such insects which are generally immune to ordinary reagents. However they either get killed or are driven away, when they come in contact with the fumes of volatile oils like camphor diffused in the environment.

Agnihotra Farming:

The disinfection of air is not only useful to animal life but also helps plant's life though the bacteria responsible for diseases in both may be different. The aromatic substances during Yagna get diffused in the air and offer protection to plant life against harmful organisms. This ensures healthy plant growth. Agnihotra's atmosphere and ash can be used as adjuvants in the 'Natural farming' methods --- also known as the Agnihotra farming methods.

It is a holistic concept of growing plants in healthy atmosphere and maintaining ecological balance by performing Agnihotra (Yagna) in the middle of the farm and using the Yagna - ash as a fertilizer. It is not only safe and productive but also holistic in its approach towards environment.

CO₂ generation in Agnihotra:

Consignment of the wood and other organic matters to flames has been always controversial because of generation of CO and CO₂ and increase in consequent 'green house' effect. It had been argued that performance of Yagna also produces CO and CO₂. It should be noted here that the way in which the Samidhas and Havishya are burnt in Yagna is a process of slow combustion at higher temperature. While the burning of coal in factories or in the household fire involves rapid combustion, where oxygen is sucked in large quantities and enormous CO₂ is emitted. In the slow combustion taking place in the process of Yagna, small quantity of O₂ is utilised meager CO₂ is emitted that poses no threat to the environment. In fact whatever CO₂ is generated it is readily absorbed by the surrounding vegetation and CO₂ cycle is strengthened. The other important aspect is the fact that CO₂ produced in Yagna is not always free CO₂ but it remains mixed with other aromatic oils and antiseptic products. It therefore, acts as a vehicle in transporting such products to distant surroundings.

The use of CO₂ as a cerebral stimulant to assist the patients suffering from lack of ventilation is common in medical world. Its use to control and cure many mental disorders is also known to medical science. Small amounts of CO₂ inhaled by the persons performing Yagna acts as a stimulant and more and more aromatic fumes are inhaled which help in curing mental disorders. Particularly effective results with respect to the elimination or reduction in radiation were achieved through Yagna's fire and ash. These observations are made by Dr. L. Maela Anatoninhowska of Poland after using P.S.I. techniques.

IV. METHODOLOGY

The entire process can be divided in following two parts:

Air sampling

- Initial condition
- After generating pollution
- After performing yagya

Generated pollution:- pollution generated by burning of following materials.

Table no.3 Quantity of the materials used for generating local and artificial pollution.

S. No.	Material	Quantity in Kg
1	Wooden powder(burada)	0.345
2	Wood coal	0.940
3	Hard coal	0.990
4	Tyre	0.440
5	Poly bags	0.400
6	Cow dung cakes	1.700
7	Mixture of (sodium potassium)	0.090

Yagya procedure details

The entire process of yagya was done under the supervision of Tapo Bhoomi Mathura, Gayatri Pariwar and the materials used were: Pipal wood (Ficus religiosa) , Clarified butter (ghee), Sweet Substances: sugar, dried grapes, Havishya:- Somalata or Giloya, Brahmi, Shankhpushpi, Nagkesar, Mulhati, Red Chandan, Baheda, Sonth and Harad kapurkachari, gugal, nagarmotha, balchhaar or jatamansi, narkachura sugandhbala, illayachi, jayphal, cloves and dalchini, A



Artificial indoor air pollution



Agnihotra

Sampling of air pollutants

For SO_x analysis TCM solution is used as absorbent

Absorbing solution:- Sox from air is absorbed in a solution of potassium tetra chloromercurate (TCM) Formation dissolve 10.86gm mercuric chloride in 1 liter of volumetric flask, add 0.066 gm EDTA, add 6.0 gm potassium chloride / sodium chloride [4.68gm] make up to one liter volume. The pH of this reagent is 4-5.

For NO_x analysis NaOH solution is used as absorbent Absorbing solution 1gm NaOH and 0.25gm Sodium Arsenite In 250 ml solution.

OBSERVATIONS:

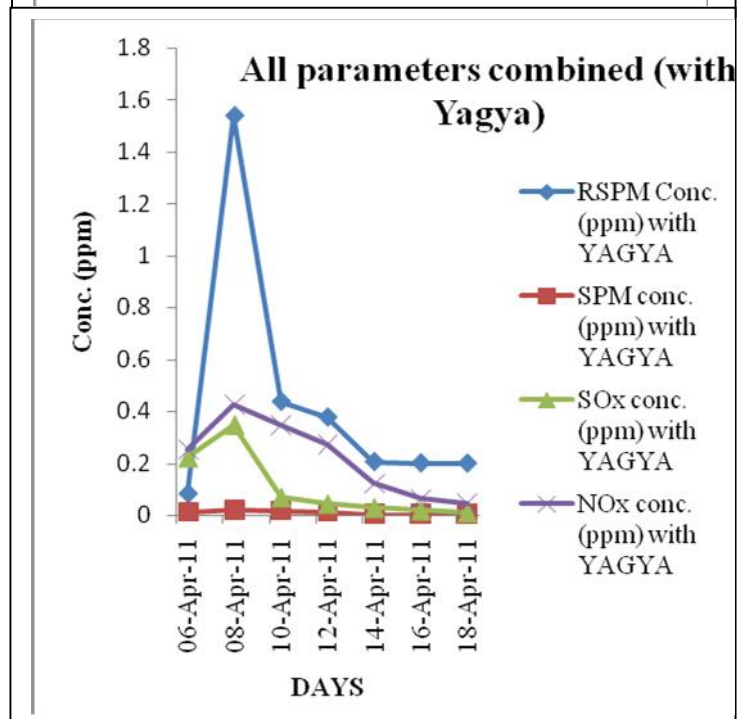
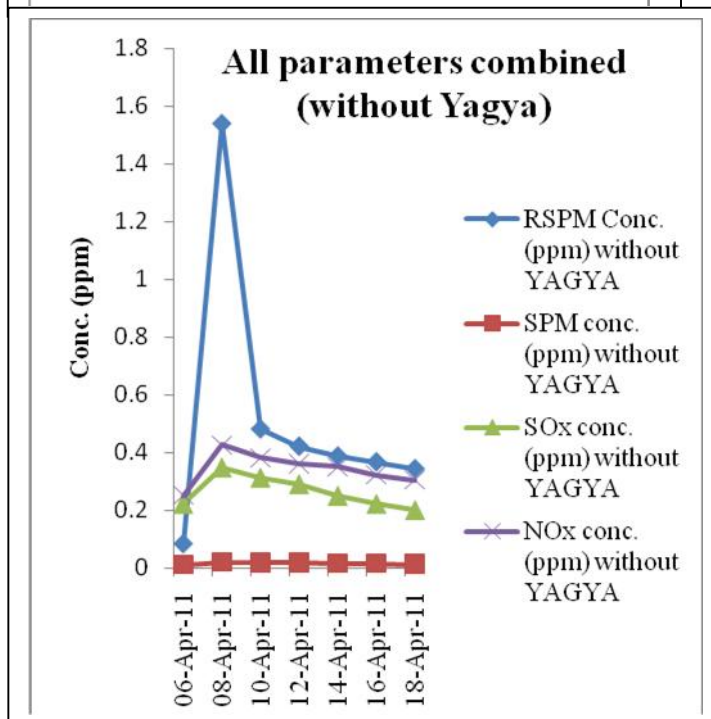
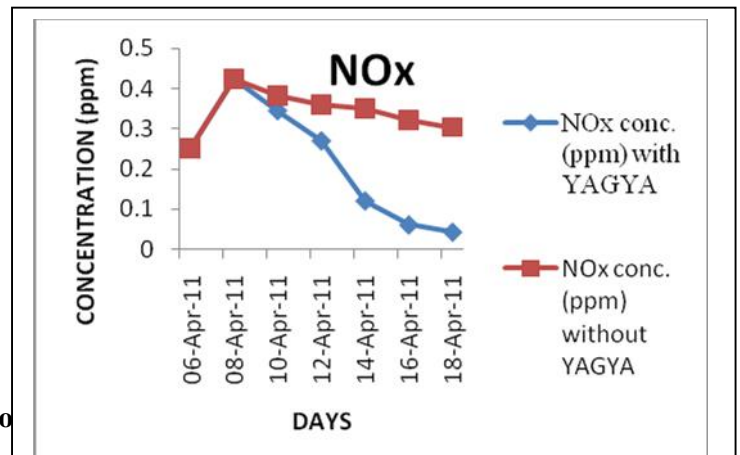
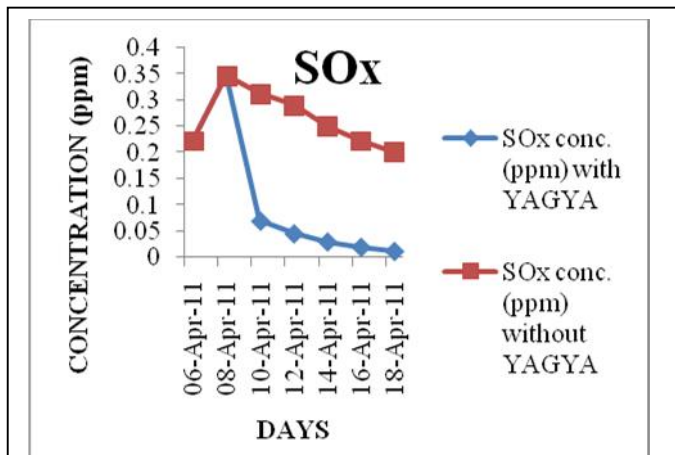
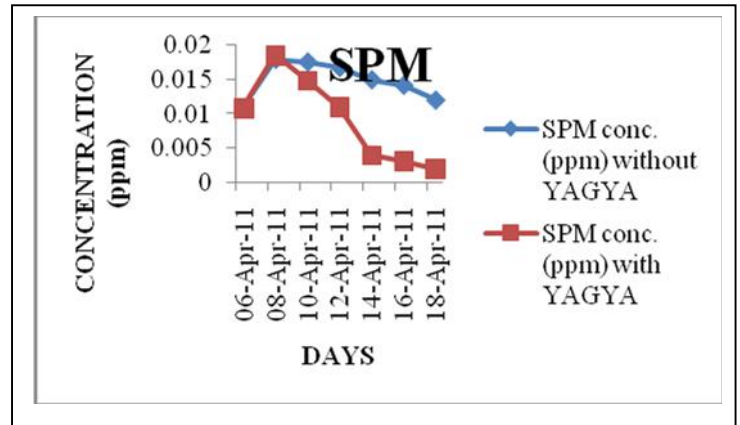
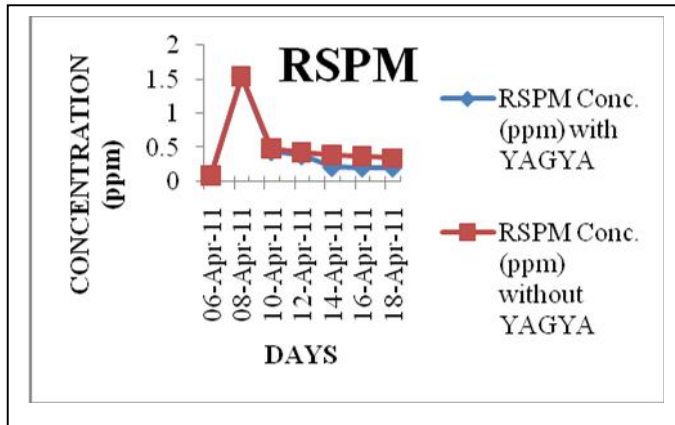


Table 4. Parameters temp, humidity, etc, during sampling

Date	Temperature in Celsius	Relative humidity in %	Sampling time	Timing	Sp. Humidity
6-apr-2011	24	17.5	14 hour	6pm to 8am	0.0045
8-apr-2011	26	30	14 hour	6pm to 8am	0.0092
10-apr-2011	25	19	14 hour	6pm to 8am	0.0052
12-apr-2011	30	40	14 hour	6pm to 8am	0.0106
14-apr-2011	28	36	14 hour	6pm to 8am	0.0101
16-apr-2011	29	34	14 hour	6pm to 8am	0.0096
18-apr-2011	30	30	14 hour	6pm to 8am	0.0092

Table no 5. Observation table for RSPM and SPM.(with Yagya)

RSPM				SPM		
Date	Initial wt of paper (gm)	Final wt. of paper (gm)	Difference (gm)	Initial wt of paper (gm)	Final wt. of paper (gm)	Difference (gm)
6-apr-2011	2.8690	2.9505	0.0815	10.2326	10.2435	0.0109
8-apr-2011	2.6938	4.2340	1.5402	10.2350	10.2536	0.0179
10-apr-2011	2.6945	3.1320	0.4375	10.2378	10.2527	0.0110
12-apr-2011	2.6528	3.0296	0.3768	10.2312	10.2422	0.0149
14-apr-2011	2.6965	2.9016	0.2051	10.2364	10.2404	0.0040
16-apr-2011	2.6233	2.8234	0.2001	10.2355	10.2387	0.0032
18-apr-2011	2.8532	3.0523	0.1991	10.2310	10.2330	.00020

Table no 6. Observation table for RSPM and SPM.(without Yagya)

RSPM				SPM		
Date	Initial wt of paper (gm)	Final wt. of paper (gm)	Difference (gm)	Initial wt of paper (gm)	Final wt. of paper (gm)	Difference (gm)
6-apr-2011	2.8690	2.9505	0.0815	10.2326	10.2435	0.0109
8-apr-2011	2.6938	4.2340	1.5402	10.2350	10.2537	0.0180
10-apr-2011	2.6940	3.1740	0.4800	10.2350	10.2526	0.0176
12-apr-2011	2.6932	3.1134	0.4202	10.2300	10.2468	0.0168
14-apr-2011	2.6820	3.0682	0.3862	10.2420	10.2570	0.0150
16-apr-2011	2.6832	3.0492	0.3660	10.2310	10.2452	0.0142
18-apr-2011	2.7502	3.0922	0.3420	10.2220	10.2320	0.0120

V. CONCLUSION

Under the natural lab conditions and after creating local and artificial indoor air pollution it was noticed that Sox, Nox were considerably reduced by almost 51%, 60% respectively more by yagya when compared without yagya and both RSPM & SPM were also found to be reduced by 9% & 65% more respectively as compared to the condition without yagya. Although the RSPM & SPM concentrations were still there but not to the extent of unhygienic conditions. The odor and smell of the Havan hall was not at all objectionable.

Acknowledgements:

The authors are thankful to Mrs. Bhawna Nimbarte and Mr. Amit Sharma the technical assistants in laboratory of Civil & Environmental Engineering, HCST, Farah, Mathura, without their support and techniques the above study would not have been so successfully possible.

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AGNIHOTRA: A BOON TO HUMANITY

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ABSTRACT

From the times unknown, the *Agnihotra* is a ritual to purify the environment using fire. *Agnihotra* is a healing fire from the vedic science of Ayurveda. During *Agnihotra* tremendous amount of energy is resonated and a magnetic field is produced which reinforce positive energies and stops negative energies. People around the world have experienced the power of *Agnihotra* to reduce stress, clarity of mind and improvement in complete health. When performed regularly every day, it enables the atmosphere to gain cosmic energy from the planetary bodies such as Sun and Moon, which has positive effect on man, plants and animals, leading to good health, balanced environment and harmony.

KEYWORDS: *Agnihotra*, *Yajnya*, *Homa*, water pollution, biodiversity

INTRODUCTION

India has been a land of traditions, rituals, beliefs and festivals. With the onset of *Navratri*, the most celebrated Hindu festival devoted to Goddess *Durga*, *Yajnya* is performed on *Homa-ashtami* i.e. the eighth day of this festival. *Yajnya* or *Yagya* or *Homa* symbolizes sacrifice and purity, underlying the principle of sacred fire ceremony. *Yajnya* when performed at a small scale in daily life i.e. at sunrise and sunset are called *Agnihotra* or *Havan* and is a process of removal of toxic substances from atmosphere through the agency of fire and Sanskrit mantras, inducing beneficial changes in atmosphere with holy fire prepared with specific organic materials, in synchronization with biorhythm of sunset and sunrise.

Agnihotra is a gift to mankind from the ancient vedic sciences of bioenergy, agriculture and climatic engineering and also stated as healing fire in ancient science of *Ayurveda* (Koch, 2004). It is a very unique ritual performed at festivals, weddings, to celebrate a birth or a time of renewal. Though *Agnihotra* is a vedic ritual, it has scientific basis and therefore have effects on environment and plants. Application of *Agnihotra* ash to enhance soil fertility results in overall bacterial flora including nitrogen fixers and phosphate solubilizers (Berde *et al.*, 2015). With reference to soil quality, increased water holding capacity and improved level of solubility of macronutrients and trace elements is observed as a direct postulate of *Homa* treatment (Paranjpe, 1989). *Agnihotra* has the credit to purify the environment and have profound impact in mitigating problem of water pollution. *Agnihotra* creates an energy field beyond the electromagnetic field which has significant impact (Berk and Sharma, 2015). It is also observed that when water is treated with *Agnihotra* ash, there is notable decrease in biological oxygen demand and microbial contamination along with solid content in water and hardness. Hence, the waste water becomes potable and can be reused in fields (Abhang *et al.*, 2015). The *Agnihotra* practices are known to purify air from the times immortal and have adverse effect on total microbial load of the air. It has been also reported that SO_x , NO_x , RSPM (Respirable Suspended Particulate Matter) and SPM (Suspended Particulate Matter) levels in the air were also considerably reduced by performance of *Agnihotra* as compared to the conditions without *Yajnya* (Sharma *et al.*, 2014).

The *Agnihotra* vapours along with ash create a holistic system for plant development by stimulating root growth in presence of light. Besides India, this potential of *Agnihotra* is being utilized in countries like Germany and Poland for organic farming (Limaye, 2013). Plants grown in *Agnihotra* environment are able to withstand drought more efficiently and causes modifications in cellular structure of plants, which translocate more nutrients to fruits rather than leaves. In words of Tejasvi Naik and Asha Naik, the receiver of prestigious ASPEE L.M. PATEL farmer of the year award in 2010, "By practising *Agnihotra homa* farming technique we have been able to manage pest and diseases. In addition the atmosphere has become pure and filled with positive energies created by the *Homa*. Leaf size and quality have improved tremendously showing its impact on the yield". They also said that the number and diversity of birds in the farm also increased surprisingly after *Agnihotra homa* farming technique (www.agriculturesnetwork.org). Hence, *Agnihotra* system is also aiding in increasing biodiversity of farms. Medicinal benefits of *Agnihotra* includes reduction in allergy and mental stress, renewal of brain cells and positive effect on circulatory and nervous system. It harmonizes the functioning of *Prana* (Life energy) and neutralizes harmful radiations.

CONCLUSION

Agnihotra can be referred as a non conventional approach to control air and water pollution, as the core aim of *Agnihotra* system is "You heal the atmosphere and the healed atmosphere heals you" and people from different parts of globe are experiencing wonders of *Agnihotra* technique by creating hygienic environment with fast healing of all sorts of ailments.

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Agnihotra: A Holistic Energy System Affecting Plant Growth (Studies on some common Household plants)

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Abstract:

*The study on the effect of 'Agnihotra' (a Vedic Procedure for purifying atmosphere) on some household plants has shown that the **polished grain vapour** is stimulating the new shoot growth in plants, while the **unpolished rice grain vapour** is stimulating tap root growth. Agnihotra ash is stimulating root growth in presence of light. Addition of Agnihotra ash helped better growth in terms of larger surface area of the leaves.*

Senescence was very fast in presence of polished grain vapour, while unpolished rice grain vapour helps in sustaining plants.

The effect of vapour on germination of Spinach seeds kept at various heights after sowing has shown that germination was fastest in the pot kept at the highest point within the easy reach of rising vapour.

Rapid cell-division was observed in presence of vapour of polished rice grains. Incidence of insect infestation of a flowering plant was also reduced to a great extent.

Introduction;

What is Agnihotra?

Agnihotra a Vedic Yaga procedure followed in the ancient times in India, a process which is known to purify the atmosphere through specially prepared fire.

According to Vedic science, "At sunrise the many fires, electricities, ethers and more subtle energies emanating from the sun extend all the way to the Earth and produce a flood effect at those coordinates where the sun is said to rise" (Paranjpe 1989).

Then yajnyas (ritual, i.e. strictly determined fires, offerings and mantras), as this system of knowledge explains, allows better absorption and transformation of incoming solar/cosmic radiation and its interaction with energies of the Earth, soil, water and living organisms. It is postulated that energies of multiple characteristics ("electricities" in plural) are involved, and at least some of them act at "a more subtle level". Jagdish Chandra Bose had proved by his experimental studies that plants grew better in respond to music. Similarly, as the reports say, Agnihotra makes the plants happy!

Reports from world over have documented the use of Agnihotra for psychological healing, gardening and farming. Agnihotra farming has been adopted in countries like, Poland, Germany etc. to increase the yield and improve the quality of the soil. Agnihotra ash is also known to cure a number of ailments.

The present study attempts to highlight the effect of Agnihotra on plant growth. The “Agnihotravapour” together with “ash” creates a holistic system for plant growth. Apart from India, this potential of Agnihotra is being utilized in countries like Germany and Poland for organic farming where Agnihotra is not only increasing yield, it is saving the environment from the use of pesticide. It kind of produces a sterile atmosphere as proved by many microbiological studies conducted in India. As Agnihotravapour rises and travels a long distance, the positive effects in a field are observed till a long radius. Being rich in nutrients, Agnihotra ash serves as fertilizer..

In Agnihotra, Rice grains are used for sacrifice. Rice grains are considered very sacred, the whole grains are known as Akshata(the one which does not get destroyed) are used in various auspicious religious ceremonies in India. Rice is in fact considered a symbol of fertility and prosperity. The present study tries to

establish this significance through scientific observations and simple experiments.

Materials & Methods

Agnihotra fire requires three inputs:

1. Specific organic substances (rice grains) burned in a copper pyramid
2. AgnihotraYaga being performed at exact timings of Sunrise and Sunset,
3. And the Vibrational inputs in the form of two short Sanskrit mantras

The fire is lit in a pyramid shaped copper vessel of specific dimensions (Base: 5.25cm*5.25cm; Area at the open end: 14.5cm*14.5 cm and height: 6.5 cm) Cow dung cakes are arranged in the vessel along the 4 sides in a way so as to allow for free passage of air. Cow ghee is applied at the lower surfaces of the cow dung cakes, whereas it is applied on the upper side of cow dung piece to be placed in the centre. A triangular cow dung cake piece on which ghee is applied on both sides is put above the central piece. Fire is lit with the help of camphor. A smoke-less fire should be ready before the Ahuti is performed at the exact Sun rise and Sunset timings. At exact sunrise and sunset time, unbroken grains of

rise smeared with little cow ghee are put in the fire along with chanting of Mantras.

Traditionally Agnihotra sacrifice requires intact (unbroken) unpolished brown rice, but for want of brown rice, initial studies were performed using unbroken polished long grained basmati rice.

After unpolished rice was available, Agnihotra and the studies were performed using the unbroken unpolished brown rice grains. A comparison of the effect of the two kinds of rice grain vapour have revealed some interesting findings. Most studies were done on Money Plant (*Epipremnum Scindapsus Aureum*).

Agnihotra was performed on a wooden shelf at a height of 2' 3" above the ground.

The experiments were performed on a double-height closed terrace having walls on east and north side. The south facing is open fitted with iron mesh. Good amount of Sun is coming through open end on west corner in the months of December-Feb end from 9.00 hours to 16.00 hours, after words. The whole area has good amount of light through out the year.

1. Experiment to study the effect of Ash

For a simple experiment 9 glass bottles were taken in three sets. Although the bottles were of 3 different sizes in a single set, but

each **Set** had similar bottles. The three sets which were formed were named as:

A, B, C

A¹ B¹ C¹

A² B² C²

In each bottle, 2-3 money plant leaves were transformed from a plant growing in the soil. The experiment was started on **27th Feb 2012**. The bottles were kept on a raised platform (3 feet above the ground) in west side of the terrace receiving sun and continued till **15th June, 2012**.

Every day after morning and evening Agnihotra, same quantity of ash (measured with Agnihotra copper spoon) was taken and was stirred in 100 ml of water. The **supernatant** was removed and transferred to a new bowl.

Group A: The ash was washed with water and allowed to settle. The water was decanted.

Very little but same amount of slurry was added to each bottle in Group A for 15 days.

Group A¹: From the supernatant equal quantities of drop was added to each bottle in the A1 group for 15 days.

Group A²: In the third category same quantity (very little) of ash as such (without washing) was added to each bottle in the group A-3 for 15 days.

The 2 money plants were taken as **control D** and **E**. The control D was a flower vase made up of an opaque material and while control E was a bottle made up of transparent material. Observations were taken after every 15 days. Pictures of the plants were also taken.

2. Comparative Study on Two Types of Rice Grain Vapour:

Agnihotra was performed alternatively with two types of rice grains for one month each, starting on 14-11-2012 and ending with 11-03-2013. Each cycle was started on New Moon's day and continued till No moon's day.

Observations were made on appearance of root growth and shoot growth on plants kept in glass bottles on raised corner (3 feet above the ground) in a west corner receiving sun and one control kept at the same position through out the period of experiment. Yellowing of the leaves if any, was also noted, observations were made on experimental plants as well as on the ornamental plants kept on the terrace.

General Observations (Sept-2011-Aug 2012) (Polished Rice Grains Vapor)1.

Two bamboo leaves kept at height of 5' 7'' for last 4 years on a switch board in a black-colored bottle had two new leaves appear after Agnihotra. Similarly money plant leaves lying dormant for 3 years in a opaque

flower vase had new leaf appeared after transferring to Agnihotra atmosphere.

2. A flowering plant had produced more flowers in Agnihotra atmosphere. The flowers had more petals than flowers produced earlier. The black insects covering the whole plant had miraculously disappeared.

3. A croton plant receiving a sun had shown profuse new whorls of leaves.

4. The Tulsi plant had too many new leaves coming up on the plants. The growth was more in the direction of the sun. A Tulsi plant reduced to a dry wood had also showed new growth. 2 new shoots were produced in an ornamental plant kept in one corner.

5. In the month of **November, 2011** I had gone to Delhi. Before going to Delhi I had put ash also in two of the bottles which had money plant leaves in it. After 10 days when I came back there was too much of roots in one bottle with no aerial growth, and in the other long roots were seen but no new aerial growth was seen. Till the end of

February, no aerial growth was observed in both the bottles. After one month of Agnihotra production of new leaves was observed.

Comparison between Two Types of Vapour

1. On *Ocimum Sanctum* (Holy Basil) polished rice grains had stimulated new growth, but a lot of old leaves were falling and degenerating. New plants were even degenerated. However, unpolished rice grain had no such effect.
2. New leaf growth was stimulated in presence of polished rice grain vapour in control plant kept at the same position after 15 days exposure as confirmed by 3 rounds of exposure.

3. Faster root generation and growth was observed between two identical plant shoots, one kept in wide-mouthed bottle and the other in narrow mouthed bottle in presence of unpolished rice grain vapour.
4. No new shoot growth was observed in experimental money plants exposed to brown or unpolished rice grains kept in glass bottles. Tap root growth was observed. However, the same plants when exposed to polished grain vapour had shown shoot growth. This new growth was observed plants kept in narrow-mouthed bottles and one control plant in the soil. However, no new growth was seen in plants kept in wide mouthed bottles.

Effect of Ash (Observations of the Experiment 27 Feb 2012- 12th June 2012)

	28th Feb	12th March	27 March	12 April	27th April	12th June
A	3 leaves	3 leaves +one leaf emerging. One root about 4.7 cm was seen, increase in shoot length	4 leaves, one root of 17 cm no branching of the root was seen	4 leaves	5 leaves (including one very small leaf)	5 leaves inter Node difference very less No yellowing
B	3 leaves	3 leaves, sheath for new leaf formation was seen Root length 3,2 cm was seen and one 1 cm	4 leaves, root length 14 cm 7.5 cm no side branching was seen	4 leaves+ One new leaf in sheath	5 leaves including one leaf curled up	5leaves , the new leaf with curled up margins inter-node difference between leaves less No yellowing of the leaves

	28th Feb	12th March	27 March	12 April	27th April	12th June
C	3 leaves	4 leaves, one new leaf curled up in sheath about to form One root about 4.5 cm one more root coming	5 leaves; 4 healthy leaves including one come out from the sheath 15.5 cm and 10.7 cm.	5 fully formed leaves	5 leaves	6 leaves very less intermodal space 2 leaves had turned yellow
A1	3 leaves (on new leaf opening)	3 leaves The root was around 12 cm long. No new leaf	3 leaves, one new leaf emerging The root was around 23.5 cm long	4 leaves	4 leaves	5 leaves one leaf very small and curled up, intermodal difference less No yellowing
B1	2 leaves	2 leaves Root lengths 6.5 and 6.7 No new growth was seen	3 leaves Root length 17 cm and 6 cm	4 leaves	4 leaves	4 leaves, no yellowing
C1	Two leaves	One root 3.4 cm second 5 cm.	2 leaves, no new growth seen root length 8 cm and 15 cm	2 leaves	2 leaves, one new shoot formed but growth inhibited	3 leaves No yellowing
A2	2 leaves	2+New leaf growth seen	4 leaves and one new leaf growth seen Roots fibrous	5 leaves	6 leaves	7 leaves. Good inter-nodal difference. No yellowing but the leaf size smaller
B2	2 leaves	3 leaves No root formation	4 leaves Roots fibrous	5 leaves	6 leaves	8 leaves Yellowing of the oldest leaf
C2	3 leaves	3 leaves, 2 roots 2 cm 1.2 cm	4 leaves	4 leaves	5 leaves	6 leaves (one new leaf formed)
D(Control)	3 leaves	5 leaves. The leaf formed had very long stalk	6 (One new leaf emerging on the 5 th leaf)	6 leaves, less intermodal space	7 leaves Now the inter nodal space had increased	9+1 leaves, one new leaf emerging one old leaf had turned yellow
E (Control)	4 leaves, roots were very long	New growth was seen	5 leaves	6 leaves	6 leaves	7 leaves, yellowing of the three old leaves

Effect on Spinach Seeds

Spinach seeds were sown in the month of **April, 2012**. One pot was kept at a height above the ground and the other at a raised platform. The sprouting of seeds in the agnihotra atmosphere was faster, the seedlings were above ground 5 days time kept at a raised platform. Twin leaves which were produced were divided in 4 leaves instantly. Even the new shoots coming out of the ground was in form of 4 leaves. But the stems were again flimsy and these also met with the same fate as discussed earlier.

Observations: (Spinach Seeds sown on 24-12-2012)

Height	5 feet	4 feet	3 and half feet		Ground level		
					Small A	B	Big
Date of Appearance seedlings	4 th day	6 day	6	8	10	11	10
Number of Seeds sown	5	5	10	10	5	5	10
Number of plants produced	5	4	13	11	8	8	16
Appearance	Growing very tall with fragile stems	Normal	Normal	Normal	Did not grew well	Did not grew well	healthy

Discussion:

Agnihotravapour produced by polished white rice grains had caused rapid cell division in croton plant. In the whorl of leaves produced there was a characteristic shape of leaf which was produced because the leaves were not separated from each other.

The seedlings produced from spinach seeds were rapidly dividing in polished grain

vapour. The rapid cell division coupled with adequate nutrients explains the increased yield in agnihotra farming. As new leaves were produced in a plant lying dormant for 4 years, the Agnihotravapour of polished rice grain plays some role in helping in the breaking the dormancy. The new leaf generation and yellowing of the leaf was observed simultaneously(the metabolism is altered) unpolished rice grain has no such effect but it had maintained a degenerating

fruit plant in good condition for more than a month, which however on exposure to polished grain vapour had got all its leaves turned yellow on 15 day exposure.

Results of the Simple Experiment:

Both in Group A and A¹ the aerial growth was inhibited. All the money plants earlier had around 3 leaves. In the end, in A and A¹ group the number of leaves never exceeded 5. The difference between the nodes was very less. Growth in A² group was the best both in terms of numbers of leaves (around 9) and the distance between the nodes. A water soluble component of ash some how acted to inhibit the aerial growth and stimulated long tap root formation as is evident from looking at the pictures of roots of A and A¹. Control D which had the maximum numbers of leaves had fibrous roots, a net work of very fine roots as compare to control E (transparent bottle) which had long tap roots.

One can notice that in each group the growth was best in narrow mouthed bottle, the best being in A2 group.

Breaking the Dormancy

A transparent bottle had too much of tap roots produced after ash was added to the bottle and left as such. No new shoot growth was produced in this plant under optimum condition, however, after exposure to

polished grain vapour new leaf growth was observed in this plant.

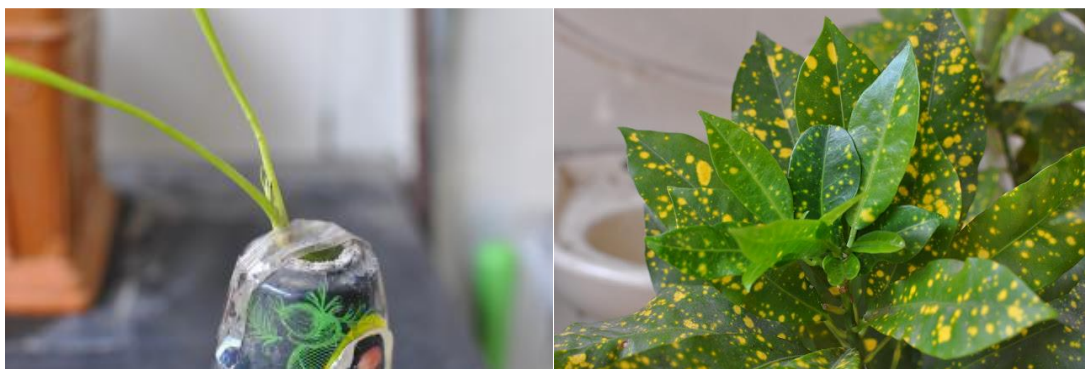
It was noticed that 2 oldest **leaves in C** (which had the maximum number of leaves in its group) had turned yellow. Similarly one of the oldest leaves in **control D** had completely turned yellow. However, in **control E** all the old three leaves after which the growth was inhibited had turned yellow.

Narrow Vs Wide Mouthed Bottles

It was seen the shoot growth was maximum in Narrow mouthed bottles. Since the narrow bottles and plant in the soil do not allow much agnihotravapour to percolate in the water less roots are produced. A water soluble component in the vapour is causing root growth in presence of light as more roots are produced in wide-mouthed bottles. The vapours are also absorbed by the leaves. When the pot with spinach leaves was shifted to raised platform the leaf surface was increased dramatically.

Agnihotra seems to have a profound impact on the root-shoot balance. This also explains the production of long roots during the monsoon period when no areal growth was observed despite enough light. A substance dissolving in atmospheric water vapour was causing such changes. These effects were more profound with the use of unpolished rice grains.

Photographs of the Observations



Appearance of new leaves in a dormant plant

Two opposite leaves had characteristic shape



Fig 4. New leaves and Senescence Appearance of leaves in the dried stem Formation of long roots in Monsoon



More shoot growth was associated with fibrous roots while long tap roots arrested areal growth both in terms of new leaves produced and distance between the nodes.

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Application of Agnihotra ash for enhancing soil fertility

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Abstract - The effect of addition of Agnihotra ash to farm soil was analysed. Four farm soil samples and one soil sample from newly purchased land were selected for the study. Initial microbial count was taken before addition of ash. Ash supplemented soil was analysed after incubation of one week. The microbial count of soil before and after ash addition was enumerated. A marked difference in the count was observed. Addition of ash results in increase in the overall bacterial flora, including the effective bacteria *i.e* nitrogen fixers and phosphate solubilisers while reduction in the fungal flora was seen.

Index terms – Agnihotra, ash, phosphate solubilisers, nitrogen fixers, soil, fertility

I. INTRODUCTION

Homa or Yajnya is a pyramid fire technique passed down from the ancient Vedas. Yajnya means a process of removing the toxic conditions of the atmosphere through the agency of fire. The resultant purified atmosphere then has positive effects on man, plants and animals [1]. The ash produced by the fire is also accredited with having healing properties. The application of Agnihotra ash for healing purposes have been described (www.homahealth.com). The ash when dissolved in water can be used as a spray on plants. The ash acts as a pesticide and fertiliser. It is also known to promote plant growth and reproduction. Furthermore, a stimulation of photosynthesis and plant respiration, which improves the entire oxygen cycle, is attributed to this atmosphere [1-5].

With regard to soil quality, an improved water holding capacity, an increase in amount and solubility (plant availability) of macro nutrients and trace elements and a stimulation of earth worm activity are postulated as a direct

result of Homa treatment [1]. Studies on germination of rice seeds were done for three seasons, autumn, winter and summer. The four parameters *i.e.* root length, shoot length; fresh weight and dry weight were checked during the studies. The results showed that Agnihotra had a significant effect on the germination process [6]. The potential of Homa farming and Agnihotra ash in particular to improve the solubility and thus the plant availability of soil P was studied by Kratz and Schnug [7].

The effects of Agnihotra and its ash on the environment and plant growth were studied. The effects of Agnihotra fumes on microbial load, SO_x and NO_x levels in ambient air and plant growth were analysed. Experiments were also conducted to check the effects of Agnihotra ash on seed germination, plant growth, plant genotoxicity and water purification. A decrease in microbial count and SO_x levels but slight increase in NO_x levels in surrounding air was observed. There was significant increase in seed germination and plant growth as well as genotoxicity was neutralized due to Agnihotra ash [8]. In another study, seeds of *Vigna aconitifolia* and *Vigna unguiculata* were taken as experimental material. Agnihotra ash promoted the process of germination [9].

In the present study, the effect of Agnihotra ash on the effective and negative microbial flora of soil was analysed. This study supports the view that Agnihotra ash can be used in increasing the soil fertility.

II. MATERIALS AND METHODS

Collection of soil samples - Farm soil was collected from 4 sites of Shri Chaitanya Mala (Dahagaon, Thane), a Homa organic farm.

- i) Soil sample kitchen garden near slurry tank, Survey no. 46/6B
- ii) Soil sample of Papaya farm Survey no.46/7

- iii) Soil sample of Mango farm Survey no. 46/7
- iv) Soil sample of Chikoo farm Survey no. 46/6B
- v) Soil sample of newly purchased land Survey no. 46/5A

Preparation of soil suspension- 10 gms of soil sample was weighed and added to 100 ml of sterile distilled water. The flask was shaken well to mix the soil properly. The flask was left standing for 10 minutes. The settled clear suspension was then used for analysis.

Total viable count- Serial dilutions of the soil suspension were prepared using sterile saline. Dilutions were done upto 10^{-4} . 0.1ml of the last three dilutions was spread plated on the nutrient agar plates. The plates were incubated and the number of colonies obtained was counted.

Fungal growth - To find the types of fungi present in the soil samples, 0.1 ml of the undiluted soil suspensions were plated on Sabauraud's agar plates. The plates were incubated and the types of colonies obtained were observed.

Effective or positive bacterial flora - 0.1ml of 10^{-4} was plated on Ashby's medium for nitrogen fixers and on Pikovaskaya's agar medium for phosphate solubilisers. The plates were incubated at room temperature and number of colonies obtained were counted.

Effect of Agnihotra ash on microbial composition of the soil - The soil samples were treated with Agnihotra ash at 1% concentration and allowed to stand for a week. Soil samples 2 and 4 were mixed together as the amount of soil for microbial and chemical analysis was less. Therefore, this sample is indicated as mixture. The microbial analysis was carried out as described above.

III. RESULTS AND DISCUSSION

The count of the microorganisms in the soil samples and soil samples mixed with ash, was taken by inoculating the soil suspensions on nutrient rich media like Nutrient agar and Sabauraud's agar media. Normal soil bacteria such as *Bacillus* sp., *Pseudomonas* sp., *Staphylococcus* sp., *Micrococcus* sp. are usually found in soil.

Two of the effective bacteria were studied i.e nitrogen fixer and phosphate solubilisers. These were isolated on Ashby's agar and Pikovaskaya's agar. Nitrogen fixers include the genus *Acetobacter* sp, *Azotobacter* sp, etc while the phosphate solubilisers belong to genus *Bacillus* sp., *Pseudomonas* sp., etc. The presence of effective bacteria in the soil that help in increasing the soil fertility by their activity were analysed. The groups analysed comprises of nitrogen fixers and phosphate solubilisers.

Table 1. Viable count of flora of soil sample 1 on different media

Media	Viable count cfu/ml
Nutrient agar	3.2×10^6
Ashby's agar	2.0×10^6
Pikovaskaya's agar	0.9×10^5
Sabauraud's agar	White cottony fungi Pink fungi Yeast colonies

All bacteria grow on nutrient agar media as it is a rich in nutrients. The total count in the soil (sample 1) was 3.2×10^6 (Table 1). Amongst these bacteria, majority is of the nitrogen fixers as count obtained is 2.0×10^6 , followed by the phosphate solubilisers. Indicates that the soil is very fertile with high count of effective bacteria. In the total bacterial composition, the nitrogen fixers and phosphate solubilising bacteria dominate. The fungi found in the soil are *Aspergillus* sp., *Neurospora* sp. and yeast. Normally found in soil and on fruits and vegetables.

In soil sample 2, the count of nitrogen fixers and phosphate solubilisers is very high (Table 2). This indicates that the soil is very fertile with high count of effective bacteria. The fungal types encountered are yeast and *Aspergillus* sp. These are the normal cultures found in soil. A similar observation was seen in case of soil sample 3 (Table 3)

Table 2. Viable count of flora of soil sample 2 on different media

Media	Viable count cfu/ml
Nutrient agar	2.5×10^6
Ashby's agar	2.8×10^6
Pikovaskaya's agar	4.6×10^5
Sabauraud's agar	Same as soil sample 1

Table 3. Viable count of flora of soil sample 3 on different media

Media	Viable count cfu/ml
Nutrient agar	5.0×10^5
Ashby's agar	3.0×10^5
Pikovaskaya's agar	1.0×10^5
Sabauraud's agar	White cottony growth with black spores; Yeast colonies

The analysis of soil sample 4 also showed result similar to soil samples 2 and 3. The count of nitrogen fixers and phosphate solubilisers is very high (Table 4). This indicates that the soil is very fertile with high count of effective bacteria. In the total bacterial composition, the nitrogen fixers and phosphate solubilising bacteria dominate. The fungal types encountered are yeast, *Penicillium* sp., *Rhizopus* sp. and *Aspergillus* sp. These are the normal cultures found in soil and decaying plant material.

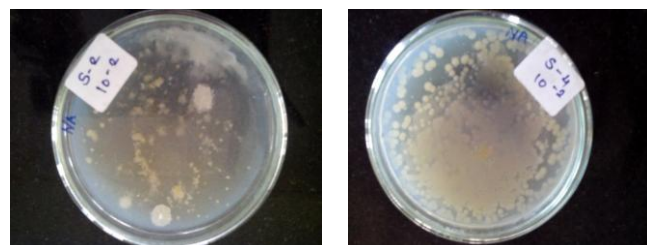
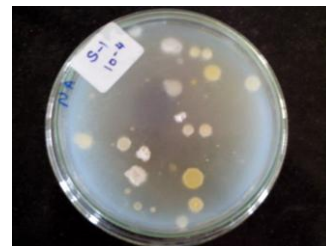
Table 4. Viable count of flora of soil sample 4 on different media

Media	Viable count cfu/ml
Nutrient agar	3.2×10^5
Ashby's agar	4.0×10^6
Pikovaskaya's agar	3.6×10^6
Sabauraud's agar	White cottony growth with black spores Growth with green spores Yeast colonies Growth with grey colonies

In the total bacterial count of control soil, there was incidence of normal soil bacteria. The count of nitrogen fixers and phosphate solubilisers is high. The fungal types encountered are yeast. These are the normal cultures found in soil and decaying plant material.

Table 5. Viable count of flora of soil sample 5 on different media

Media	Viable count cfu/ml
Nutrient agar	1×10^6 Yellow colonies innumerable
Ashby's agar	1.2×10^5
Pikovaskaya's agar	2×10^5
Sabauraud's agar	Yeast colonies

**Fig. 1 Growth of bacterial cells obtained from soil on nutrient agar****Fig. 2 Growth of bacterial cells obtained from soil on Ashby's agar****Fig. 3 Growth of bacterial cells obtained from soil on Pikovaskaya's agar**

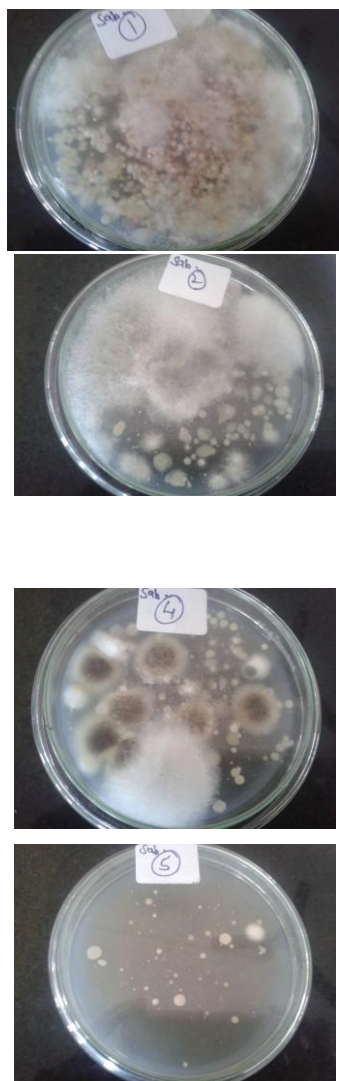


Fig. 4 Growth of fungal cultures obtained from soil on Sabouraud's agar

Soil was supplemented with ash and incubated for a week. The microbial flora encountered was higher in numbers. The effects of addition of ash are seen very distinctly in the results depicted below.

Table 6. Viable count of flora of Soil sample 1 with ash on different media

Media	Viable count cfu/ml
Nutrient agar	5.9×10^7
Ashby's agar	1.0×10^7
Pikovaskaya's agar	2.6×10^7
Sabouraud's agar	No growth

After addition of 1% Agnihotra ash, an overall increase in the bacterial count is observed from 3.2×10^6 to 5.9×10^7 , in case of soil sample 1. Among these, the nitrogen fixers and the phosphate solubilisers are major contributors and their number is also seen to increase significantly. The count of nitrogen fixer was seen to increase 100 fold while that of phosphate solubilisers was 1000 fold. Thus, after addition of Agnihotra ash, the soil fertility of sample 1, in terms of the nitrogen fixers and phosphate solubilisers is found to increase immensely.

Another significant observation is the inhibition of fungal growth. No growth was observed on the Sabouraud's media.

Table 7. Viable count of flora of Soil sample 3 with ash on different media

Media	Viable count cfu/ml
Nutrient agar	1.0×10^7
Ashby's agar	1.0×10^6
Pikovaskaya's agar	1.09×10^7
Sabouraud's agar	No growth

The observations for soil sample 3 after addition of Agnihotra ash were similar to the results obtained in case of soil sample 1, above. The count of phosphate solubilisers is found to increase greatly (Table 7). Growth of fungi is inhibited. Thus, after addition of Agnihotra ash, the soil fertility of sample 3, in terms of the nitrogen fixers and phosphate solubilisers is found to increase.

Table 8. Viable count of flora of Soil mixture with ash on different media

Media	Viable count cfu/ml
Nutrient agar	1.2×10^7
Ashby's agar	2.2×10^6
Pikovaskaya's agar	4.8×10^6
Sabouraud's agar	No growth

On comparing the results of soil sample 2 and 4 (before ash addition) to the mixture of the two soil samples (2 & 4), to which Agnihotra ash was added, increase in bacterial count is obtained (Table 8). As in the above cases, the count of phosphate solubilisers is seen to increase. . Thus, after addition of Agnihotra ash, the soil fertility of mixture, in

terms of the nitrogen fixers and phosphate solubilisers is found to increase.

Table 9. Viable count of flora of soil sample 5 with ash on different media

Media	Viable count cfu/ml
Nutrient agar	1.2×10^7
Ashby's agar	3.8×10^6
Pikovaskaya's agar	7.2×10^6
Sabauraud's agar	No growth

A 100- fold increase in the numbers of nitrogen fixers as well as phosphate solubilisers is observed. It was also observed that the pinpoint yellow coloured culture seen in untreated soil was reduced drastically. Secondly, the growth of fungi is inhibited. Thus, after addition of Agnihotra ash, the soil fertility of sample 5, in terms of the nitrogen fixers and phosphate solubilisers is also found to increase.

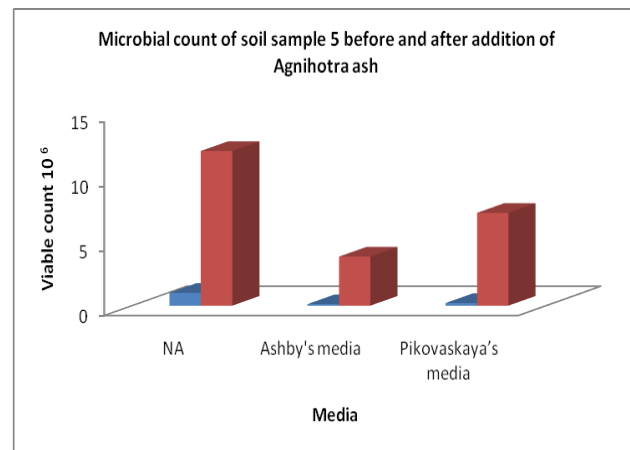


Fig. 7. Microbial count of soil sample 5 before and after addition of Agnihotra ash

Comparing the results of the three soil samples, it can be concluded that:

- Soil samples 1-4 showed good effective microbial composition, prior to addition of Agnihotra ash. This is indicative of good soil fertility, it being an organic farm.
- A further increase in nitrogen fixing, phosphate solubilisers and overall bacterial count, after addition of Agnihotra ash, is seen in all soil samples.
- Addition of ash increases the phosphate solubilisers more than the nitrogen fixers.
- Thus, addition of Agnihotra ash to the soil positively increases the number of effective organisms while suppressing the fungal growth.

In all the sample, the ratio of positive to negative microorganisms is 100:0. *i.e* the soil contains 100 % positive or effective microorganisms upon treatment with Agnihotra ash

V. ACKNOWLEDGEMENT

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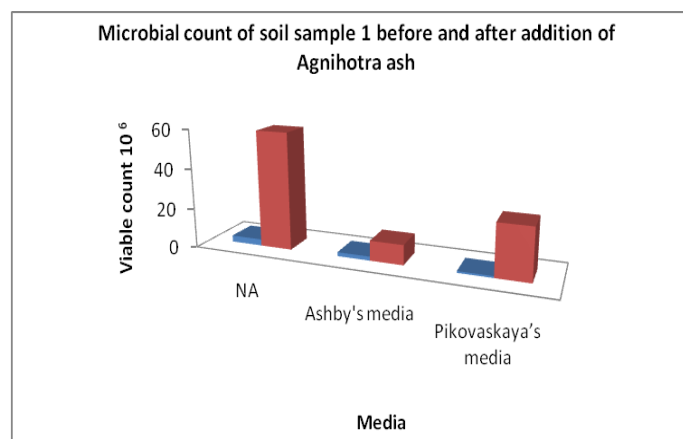


Fig. 5. Microbial count of soil sample 1 before and after addition of Agnihotra ash

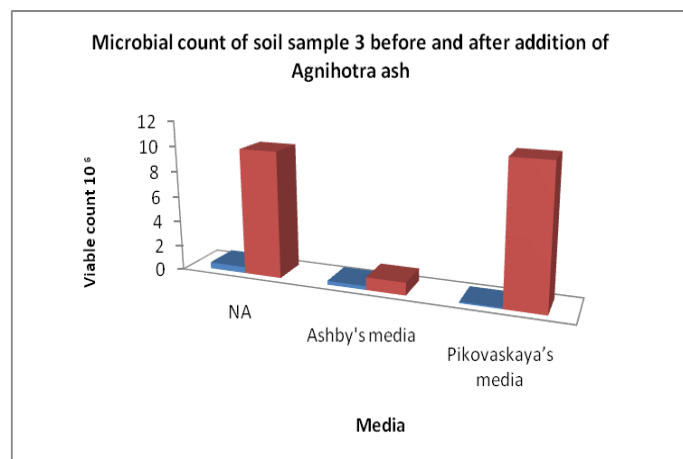


Fig. 6. Microbial count of soil sample 3 before and after addition of Agnihotra ash

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BENEFICIAL EFFECTS OF AGNIHOTRA ON ENVIRONMENT AND AGRICULTURE

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ABSTRACT

Agnihotra is a type of sacrifice, which consists of making four offerings per day, two at sunrise and two at sunset of brown rice mixed with cow ghee to the fire, accompanied by chanting of mantras. Though Agnihotra is a Vedic ritual, it has scientific background and therefore we studied the effects of Agnihotra and its ash on the environment and plant growth. Experiments were performed to study the effects of Agnihotra fumes on microbial load, SO_x and NO_x levels in ambient air and plant growth. Experiments were also conducted to check the effects of Agnihotra ash on seed germination, plant growth, plant genotoxicity and water purification. From the study it was observed that Agnihotra resulted in reduction in microbial load and SO_x levels but slight increase in NO_x levels in surrounding air. There was significant increase in seed germination and plant growth as well as genotoxicity was neutralized due to Agnihotra ash. Our results suggest that Agnihotra ash can be used to purify waste water. It can be seen that Agnihotra is beneficial for environment and agriculture.

KEYWORDS: Agnihotra, Vedic Ritual, Sox Level, Nox Level, Plant Growth, Genotoxicity, Water Purification

INTRODUCTION

Agnihotra Yajnya is performed daily, at sunrise and sunset. Pieces of dried cow dung cakes are piled up in an inverted copper pyramid with specific dimensions and lighted; oblation of brown rice mixed with cow ghee is given while chanting specific mantra. Different mantras are chanted for sunrise and sunset. Although it is a simple vedic ritual, it emerges many questions about specific materials used in Yajnya and its uses. These questions can be resolved by studying overall process of Agnihotra, fumes generated during process which spread in ambient air and ash generated after Yajnya. Effects of Agnihotra on microbial content of air (Purandare V. R. and Prasad N. B, 2012; Mondkar A. G., 1982), germination of rice seeds (Heisnam J. Devi et al, 2004), growth of mushroom (V. Indira et al, 2010), scabies in rabbits (Mondkar A. G., 1982), skin wounds (Rao D V K, 1987) and radioactivity in air (Matela Leszek, 1988) have been reported.

Work done on Somyag Yajnya fumes (Abhang Pranay, 2015) showed reduction in sulfur oxides (SO_x) and microbial load in the air. Somyag Yajnya differs from Agnihotra in terms of oblations used in it. *Somawali*, stalks of Ephedra (Wojciech Puchalski, 2009), twigs of Banyan, Pimpal, Mango and many more plants are used in Somyag Yajnya. Somyag Yajnya as well as Agnihotra is performed to regulate seasonal cycle and maintain equilibrium, but both Yajnyas differs in terms of time period, number of people chanting the mantra at a time and the cost of materials required for the Yajnya.

Air contains pollutants like oxides of nitrogen and sulfur, hydrocarbons and pathogenic microorganisms (Richa Rai et al., 2011). There is impact of these air pollutants on plant growth (Richa Rai et al., 2011 and S. Tiwari et. al., 2006). Sustainable agriculture and ambient environment are correlated with each other (L. Horrigan et al. 2001). In agriculture, there are problems like delay in seed germination, slow growth of plants and adverse effects due to toxicity of insecticides and fertilizers used. Study was done to check if Agnihotra can be implemented to overcome all these problems. The purpose of the study was to find out the effect of Agnihotra fumes and Agnihotra ash on the different aspects of environment and agriculture. The experiments were carried out in New English School, Ramanbaug, Pune and Biotechnology Department, Fergusson College, Pune.

MATERIALS AND METHODS

Agnihotra was performed as mentioned by V. Indira et al (2010), using known amount of materials. About 100 gm of dried cow dung was arranged in an inverted pyramidal copper pot of dimensions 14.5 x 14.5 cm at the top 5.25 x 5.25 cm at the bottom and 6.5 cm in height. Fire was lit using 18 ml purified cow ghee and offerings of 2 gm brown rice mixed with 2 ml of purified cow ghee was given by chanting following mantras,

At Sunrise -

Sooryaya swááhá, Sooryáya idam na mama/

Prajápataye swááhá, Prajápataye idam na mama//

At Sunset -

Agnaye swaáhá, Agnaye idam na mama/

Prajápataye swaáhá, Prajápataye idam na mama//

To study effect of Agnihotra fumes, experiment was performed during sunrise in a closed room and the ash was collected for experimentation to find out its effect.

Study the Effects of Agnihotra Fumes

Estimation of Microbial Load in Ambient Air

To study the effect of Agnihotra fumes on microbial load in the surrounding air, passive monitoring of air samples was done by settle plate method which was used by Pathade G. and Abhang Pranay (2014) (Acquarella C., 2000). In this method, sterile nutrient agar plates were kept open 5 min. before and 5 min. after the Agnihotra, at the distance of 10 feet from the Yadnya. Plates were incubated at 37°C and colony count was taken after 30 hours.

Estimation of SO_x and NO_x

SO_x and NO_x in the ambient air was collected by using air handy sampler (Spectralab, HDS -8). Methods used by Abhang P. (2015) were employed to estimate oxides of sulfur and nitrogen. SO_x was estimated by improved P. West - Gaeke method (1956) and NO_x was estimated by modified Jacobs - Hochheiser method (J. Blacker and R. Brief, 1972). Samples of SO_x and NO_x were collected 30 min. before, during and 30 min after Agnihotra, at 10 feet away from Yadnya. Control samples were collected from the area where Yadnya was not performed.

Effect of Agnihotra Fumes on Plant Growth

Two pots of 20 germinated seeds of moong (*Vigna radiata*) were maintained for 5 days by providing same amount of water, light and other environmental conditions. 10 seedlings with same shoot and root length were selected and planted in two separate pots. One was kept in room where Agnihotra was performed and another was kept in normal room where Agnihotra was not performed. Plant growth was measured in terms of shoot and root length within 5 days by providing same amount of water, light and other environmental conditions.

Study the Effects of Agnihotra Ash

Analysis of materials used in Agnihotra

Analysis of Cow dung cakes, Brown rice, cow ghee, cow dung ash, brown rice ash and Agnihotra ash was done using atomic mass spectroscopy in Kulkarni Laboratory and Quality Management Services, Pune (Accredited by ISO & NABL).

Effect of Agnihotra Ash on Seed Germination and Plant Growth

To study the effects of Agnihotra ash on seed germination and plant growth, soaked seeds of chickpea (*Cicer arietinum*) were used. The seeds were allowed to germinate separately in A. distilled water; B. Agnihotra ash; C. cow dung ash and D. rice ash. The number of germinated seeds was counted after 36 hours. To check the effect on plant growth, length of shoots and roots were measured (in cm) after 5 days.

Genotoxicity Neutralization Assay

To check neutralization effect of Agnihotra ash, onion root tip assay for genotoxicity was performed (Matsumoto et al. 2006). Seeds of onion were treated with A. Distilled water; B. Agnihotra ash; C. Cow dung ash and D. Rise ash. To check the effects of genotoxicity neutralization, 0.5 mg/ml colchicine was used and seeds were treated with E. Only Colchicine; F. Colchicine + Agnihotra ash; G. Colchicine + Cow dung ash and H. Colchicine + Rise ash. Mitotic index of all samples were calculated and compared.

Water Purification

To study the effect of ash on raw water, a column of about 100 gm of tightly packed Agnihotra ash with 20 cm of height and 2.7 cm of diameter was prepared. Before experimentation, the column was washed with distilled water and then 500 ml of raw water collected from Mula – Mutha River, Pune, MH, India (a source at which municipal waste water is mixed with river) was passed and collected for analysis. Following parameters were considered to check potability of water pH, Color, Odor, Conductivity, Total solids, Total dissolved solids, Total suspended solids, Total hardness, Biochemical oxygen demand, Chemical oxygen demand, Most probable number and Standard plate count (Table 2).

Water sampling, storage, analysis and estimation of parameters were done according to the guidelines given by Central Pollution Control Board (CPCB), Delhi (2007-2008).

RESULTS AND DISCUSSIONS

Effect of Agnihotra Fumes on Microbial Load in Surrounding Air

The average microbial colony count after Agnihotra was 52 CFU/m³/min which were 70% less than the colony count before Agnihotra 171 CFU/m³/min (Graph 1).

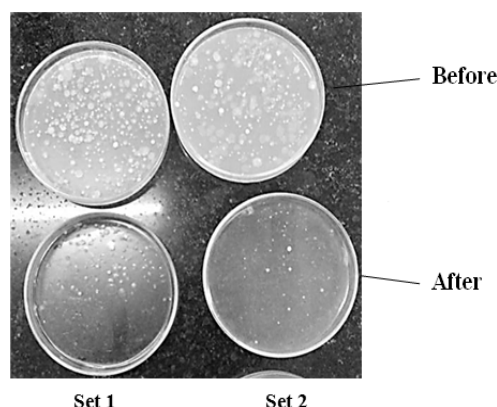
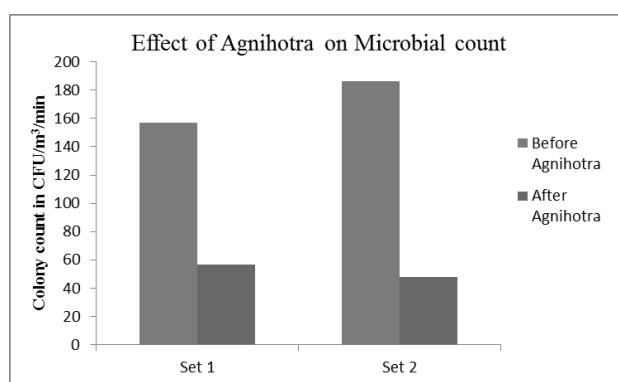


Figure 1: Nutrient Agar Plates Opened Before and After Agnihotra



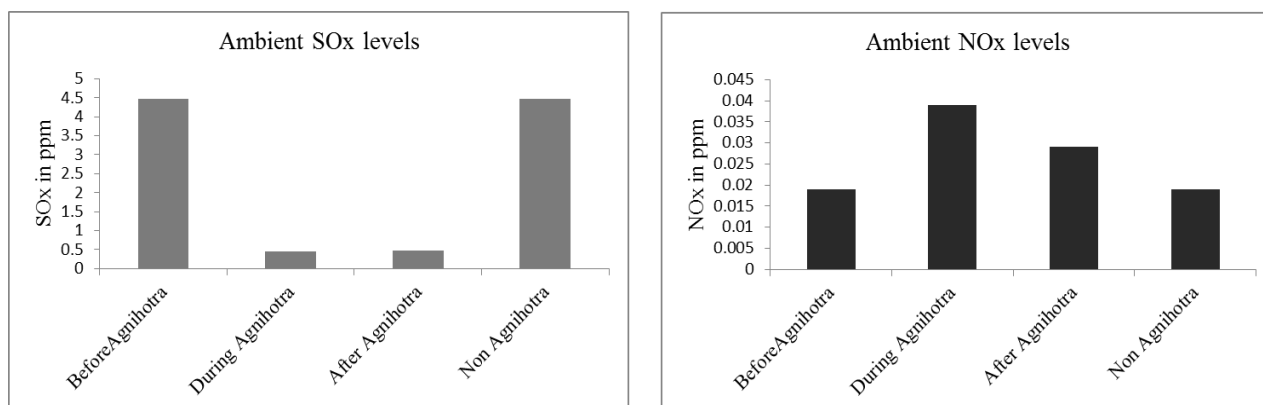
Graph 1: Effect of Agnihotra Fumes on Microbial Count in Surrounding Air

From the result (Figure 1) it was seen that microbial count after Agnihotra was significantly reduced than the microbial count before Agnihotra. This suggests that Agnihotra fumes may have anti-microbial properties.

Effect on SO_x Level and NO_x Levels

SO_x level reduces by 89.37% during Agnihotra as compared to initial levels (from 4.4729 ppm to 0.4758 ppm), and remains lower than initial levels after Agnihotra (Graph 2, SO_x levels).

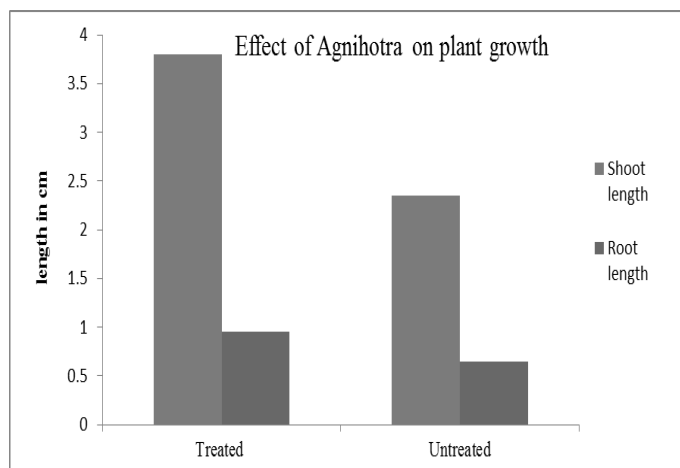
NO_x level increases up to 50% (from 0.019 ppm to 0.039 ppm) that of initial levels during Agnihotra. After Agnihotra, NO_x level decreases up to 25% i.e. from 0.039 ppm to 0.029 ppm (Graph 2, NO_x levels).



Graph 2: Effect of Agnihotra on SO_x and NO_x Level in Ambient Air

Effect Agnihotra on Plant Growth

The average shoot and root length of the seedlings treated with Agnihotra fumes was 3.8 cm and 0.95 cm respectively whereas the shoot and root length without Agnihotra treatment was 2.35 cm and 0.65cm respectively. The result shows 38% and 31% more growth in shoot length and root length in the seedling treated with Agnihotra fumes (Graph 3).



Graph 3: Effect of Agnihotra on Plant Growth, Graph Shows Shoot and Root Length of Seedlings Treated with Agnihotra and Control as Untreated I. E. without Agnihotra

Analysis of Materials Used in Agnihotra

Analysis of Agnihotra material and ash is recorded in following Table 1.

Table 1: Analysis of Brown Rice, Brown Rice Ash, Cow Dung, Cow Dung Ash, Cow Ghee and Agnihotra Ash

Sr. No.	Test Parameter in Percent	Sample					
		Brown Rice	Brown Rice Ash	Cow Dung	Cow Dung Ash	Cow Ghee	Agnihotra Ash
1	Volatile matter	0.1	0.02	0.2	0.05	-	0.04
2	Ash content	0.34	86.3	14.7	1.4	0.003	84.7
3	Iron (as Fe)	0.02	0.12	0.05	0.09	-	0.13
4	Aluminum (as Al)	-	1.5	-	-	-	1.2
5	Copper (as Cu)	-	-	-	-	-	-
6	Zinc (as Zn)	-	-	0.01	-	-	-
7	Calcium (as Ca)	0.1	1.4	1.1	0.35	0.0025	0.6
8	Magnesium (as Mg)	0.05	0.12	1.2	0.22	-	0.2
9	Potassium (as K)	0.053	2.5	0.19	0.28	5.1×10^{-4}	2.7
10	Manganese (as Mn)	8.9×10^{-4}	0.03	33×10^{-4}	0.0045	-	0.023
11	Silica	0.07	-	-	-	-	-

Iron, Potassium and Manganese content was increased after burning of brown rice and cow dung, which contributes as iron (Fe), Potassium (K) and Manganese (Mn) in Agnihotra ash. Presence of aluminum in Agnihotra ash is due to burning of brown rice.

Calcium and Magnesium content increases in brown rice and decreases in cow dung after burning. Cow ghee contributes as calcium and potassium source to Agnihotra ash.

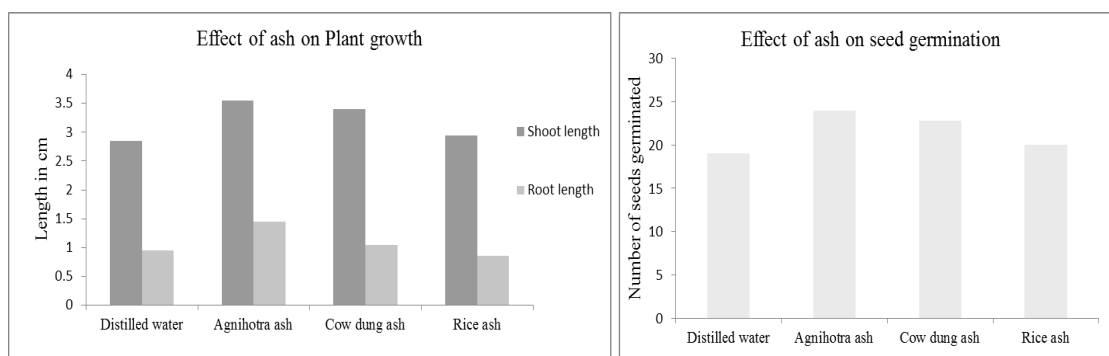
Our result shows that copper, zinc, and silica are absent in Agnihotra ash though there is presence of zinc and silica in cow dung and brown rice respectively.

Iron and potassium content of Agnihotra ash was higher as compared to ash from brown rice and cow dung. On the other hand, Calcium, magnesium, manganese content of Agnihotra ash was lower than that of brown rice ash and cow dung ash.

Effect of Agnihotra Ash on Plant Growth and Seed Germination

Seedlings treated with Agnihotra ash showed more growth as compared to others i.e. treated with cow dung ash, rice ash and control (water). There is 24% increase in plant growth when treated with Agnihotra ash as compared to control (distilled water). (Graph 4, plant growth).

The number of germinated chickpea seeds treated with Agnihotra ash was more than that of seeds treated with rice ash and cow dung ash. Seed germination increased by 24 %, 5% and 20% due to Agnihotra ash as compared to control (distilled water), cow dung ash and rice ash respectively (Graph 4. seed germination).

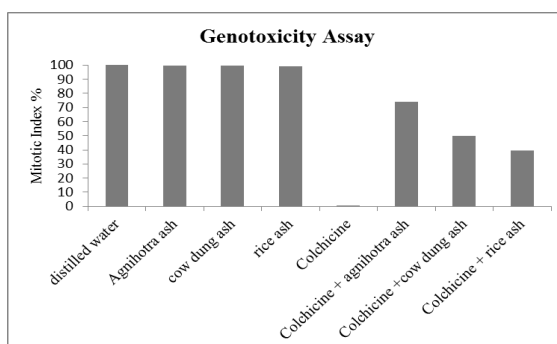


Graph 4: Effect of Agnihotra Ash on Seed Germination and Plant Growth, Graph Shows Comparison between Agnihotra Ash with Distilled Water, Cow Dung Ash and Rice Ash

Analysis of Agnihotra ash has shown presence of potassium, calcium and magnesium, Iron. These nutrients are essential for plant growth. Therefore the study suggests that Agnihotra ash must have supplied these essential nutrients and resulted in increased growth of the seedlings.

Neutralization of Genotoxicity

Agnihotra ash neutralizes genotoxicity due to harmful chemicals. Results (Graph 5) show that, 74%, 50% and 40% mitotic index due to Agnihotra ash, Cow dung ash and Rice ash respectively.



Graph 5: Genotoxicity Assay to Study Neutralization Effect

Water Purification

Polluted water when passed through a column of Agnihotra ash, there is significant reduction in conductivity (reduces 48.28%), total solid content (reduces about 90%), hardness (reduces 83.75%), Biological oxygen demand (reduces up to 48.4%) and chemical oxygen demand (reduces up to 7.15%) which is mentioned in Table 2.

Agnihotra ash shows antimicrobial properties, as microbial (especially pathogenic bacteria) count reduces up to 95% (Sr. No. 11 and 12 in Table 2). pH of treated water become neutral, color and odor was acceptable after the treatment of Agnihotra ash.

Raw water (non-potable) becomes potable (results matches with standards given by WHO Guidelines for Drinking-water Quality) after the treatment with Agnihotra ash, hence our study suggests that Agnihotra ash can be used in the process of water purification.

Table 2: Purification of Polluted Water by Using Agnihotra Ash, Table Showing Estimation of Polluted Water Parameters Before and After Treatment of Agnihotra Ash

Sr. No.	Parameters	Sample	Sample Treated with Agnihotra Ash
1.	pH	6.1	7.1
2.	Color	whitish	colorless
3.	Odor	Unacceptable	Acceptable
4.	Conductivity	406 μ s/cm	210 μ s/cm
5.	Total solids	1432.05 mg/l	165 mg/l
6.	Total dissolved solids	1426.5 mg/l	161 mg/l
7.	Total suspended solids	5.55 mg/l	0 mg/l
8.	Total hardness	160 mg/l	26 mg/l
9.	Biochemical oxygen demand	9.3 mg/l	4.8 mg/l
10.	Chemical oxygen demand	11.2 mg/l	10.4 mg/l
11.	Most probable number	75 CFU/ml	1 CFU/ml
12.	Standard plate count	45 CFU/ml	3 CFU/ml

CONCLUSIONS

From the study, it was seen that the microbial load, SO_x levels in the air were reduced by performance of Agnihotra. NO_x levels though increased after Agnihotra, but were still below the threshold limit of 0.053 ppm as per the guidelines of National ambient air quality standards (NAAQS) and Maharashtra pollution control board. The plant growth with treatment of Agnihotra fumes and the number of seeds germinated when treated with Agnihotra ash was higher as compared to seedlings not treated with Agnihotra ash and Agnihotra fumes. As per our results, it can be seen that raw water when treated with Agnihotra ash, there is notable decrease in biological oxygen demand and microbial load along with solid content in water and hardness. This suggests that waste water becomes potable and can be reused in fields. From the above results, it can be seen that if Agnihotra is performed and its ash is used in agriculture, it may result in reduction of pollution and increase the growth of the crops.

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Effect of *Agnihotra* energy field on water purification

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Agnihotra is a special fire performed exactly at the time of sunrise and sunset in a copper pyramid. It comes from ancient Vedic Knowledge. *Agnihotra* is said to purify the environment and especially it has been found to have profound impact in mitigating water pollution problem. The present study shows that water will be purified if it is kept in a room where *Agnihotra* is regularly performed. Water purification also happens if water bottles are kept inside a Faraday Cage in the *Agnihotra* room. These results suggest that *Agnihotra* creates an energy field beyond the electromagnetic field which has profound impact.

Keywords: Water purification, *Agnihotra*, Energy field, *Prana*, *Vedas*

IPC Int. Cl.⁸: C02F, F23, F24, F16L55/02, F16H 33/00

Availability of potable drinking water is becoming increasingly a worldwide problem. Dumping of industrial wastes, radiation coming from the bowels of the earth and from a number of human activities, atmospheric pollution, all are affecting availability of water suitable for human consumption and for agricultural use. This, coupled with acid rains further aggravates the situation. Therefore, inexpensive and easily available methods of water purification are becoming more and more important. Some reports suggest that the ancient method of *Agnihotra* may offer a cheap and affordable solution.

Preliminary tests have shown that if *Agnihotra* ash is added to polluted water, it gets purified (Mondkar¹, Gerlecka², Matlander³). Further, Matlander showed that if you not only add *Agnihotra* ash to water but also keep the water in *Agnihotra* atmosphere (in a room where *Agnihotra* is performed regularly), the reduction of pathogenic bacteria is higher. Sharma⁴ then went one step further and did not add *Agnihotra* ash but just kept water bottles next to a *Somayag* (a long lasting process of fire purification - but which is also based on the principles of *Agnihotra*). Observation was that also in this case water was purified. But since the bottles were open, a chemical effect of smoke particles cannot be excluded.

Sharma⁵ also showed that *Agnihotra* atmosphere not just locally purifies water but leads to the purification of a whole river in its vicinity.

The object of the present experiment was to see whether just *Agnihotra* atmosphere without any effect

of *Agnihotra* ash or *Agnihotra* smoke would be able to improve water quality (*Agnihotra* atmosphere has been reported to have a positive effect on the sprouting of seeds, see Devi/Swamy/Nagendra⁶).

A first test showed that after a period of 5 days the count of *Coliform* bacteria was reduced by more than 50% compared to control (same water kept in the laboratory during these 5 days).

As any chemical reaction with either ash or smoke of *Agnihotra* was excluded the effect could only be in terms of physics. This leads to the assumption that regular performance of *Agnihotra* creates some kind of energy field which helps to purify water. But which kind of energy field could this be?

In every day life the most common energy fields are electromagnetic fields. Could it be that electromagnetic fields lead to the purification effect of *Agnihotra* on water?

In order to find out whether electromagnetic fields generated by *Agnihotra* are responsible for the improvement of water quality the following systematic studies were designed. It is well known that Faraday Cages shield electromagnetic waves. Therefore, if the effects of *Agnihotra* on water are (partly) based on some electromagnetic waves, then there would be no (less) change in the parameters of water quality if this water is kept in such Faraday Cages. This was to be tested.

Materials and methods

1) *Agnihotra*

Agnihotra is the smallest and basic Homa healing fire which is performed in a copper pyramid of fixed

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size and shape, tuned to the biorhythm of sunrise/sunset. It comes from the ancient most *Vedic* Sciences of Bioenergy, Medicine, Agriculture and Climate Engineering. This knowledge has been revived by Shree Gajanan Maharaj from Akkalkot, Maharashtra last century and taught worldwide by his disciple Shree Vasant Paranjpe⁷. A compilation of recent research on *Agnihotra* and Homa Therapy is given in Berk/Johnson 2009⁸.

In this ancient tradition sunrise is described as follows:

“At sunrise the many fires, electricities, ethers and more subtle energies emanating from the sun extend all the way to the Earth and produce a flood effect at those coordinates where the sun is said to rise. It is awesome. The flood enlivens and purifies everything in its path, destroying what is impure in its wake. This torrent of life-sustaining energies causes all life to rejoice. At sunrise that music can be heard. The morning *Agnihotra Mantra* is the essence of that music. It is the quintessential sound of that flood. At sunset the flood recedes” (Paranjpe 1989).

- 1 The materials used for present study consist of following:

A pyramid shaped copper container, 14.5 cm x 14.5 cm at the top, 5.25 x 5.25 cm at the bottom and 6.5 cm in height.

- 2 Fire prepared with cow dung patties duly smeared with cow's ghee and its offering to fire along with chanting following *Agnihotra Mantras*.

At sunrise:

Sooryáya swáhá, sooryáya idam na mama prajāpataye swáhá, prajāpataye idam na mama

At sunset:

Agnaye swáhá, agnaye idam na mama prajāpataye swáhá, prajāpataye idam na mama

2) Conducting the experiment

For the experiment water was taken with a bucket from the Narmada River in Mandleshwar, Madhya Pradesh, India (22° 10' 29" North, 75° 39' 59" East). The water was stirred and then distributed into glass bottles for experimentation.

Three bottles for control were immediately brought to the laboratory of Shri Umia College, Mandleshwar, MP (first two replications) and of AIMS College, Dhamnod, MP (third replication plus several control experiments). The measurements took place between October 2012 and February 2014.

Seventeen bottles were brought to the Homa Therapy Goshala in Maheshwar, MP. Three each of the bottles

filled with water were put in containers made of stainless steel, copper and aluminum, respectively. Care was taken that there was no direct contact between the bottles and the metal containers. At the bottom of the metal containers a piece of dried cow dung was placed and at the sides a distance of one cm was kept. Then, the metal containers were closed with a tightly fitting lid in order to get Faraday Cages.

In addition to these 9 water bottles enclosed in metal containers for comparison, also 8 bottles without metal containers (filled with the same water from Narmada River) were used.

All these bottles were placed in the *Agnihotra* hut at Maheshwar Homa Therapy Goshala where *Agnihotra* has been performed regularly exactly at sunrise and sunset. No other activities are going on in this *Agnihotra* hut, and no words other than mantras related to *Agnihotra* are spoken there.

Figs. 1 & 2 show both shielded and unshielded bottles in the *Agnihotra* hut, and Fig. 3 shows the arrangement of all water bottles for the experiment.



Fig. 1 - Left side: Water bottles in metal containers; Right side: *Agnihotra* is performed in the left-hand pyramid



Fig. 2 - Unshielded bottles

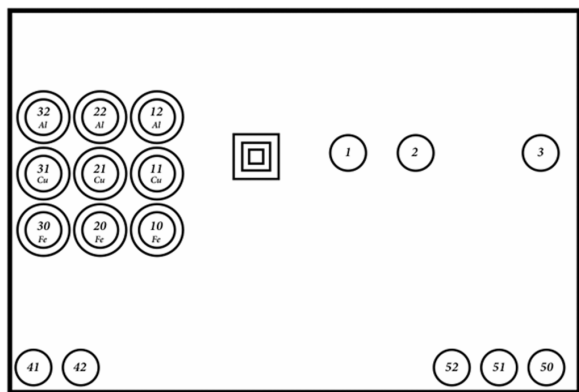


Fig. 3 - Array of shielded and unshielded bottles. One circle - unshielded bottle. Two circles - shielded bottle, metal is indicated

The temperature in the *Agnihotra* hut (where the experimental samples were kept) and the office room of the laboratory (where the control samples were kept) showed only minor differences.

After 5 days all water samples were taken out from the *Agnihotra* hut and brought to the laboratory for testing. These samples plus those kept there for control were examined for the most important physico-chemical parameters of water: Dissolved Oxygen (DO), pH, Chemical Oxygen Demand (COD), hardness, and count of *Coliform* bacteria.

Physico-chemical parameters of water were determined as per standard methods of APHA⁹ and Welch¹⁰.

Parameters like temperature, pH, Dissolved Oxygen (DO), and turbidity were determined at the site, while other parameters like Chemical Oxygen Demand (COD), chloride, phosphate, nitrate, alkalinity, free CO₂, total solids were determined in the laboratory.

The tests were conducted according to single blind protocol: To prevent bias in the results all bottles were marked with numbers only before testing in the laboratory.

Results and discussion

The experiment was done with three replications. All showed considerable improvements in water quality compared to control in all the five parameters tested. Table 1 shows the results in detail, Table 2 shows the percentage changes as compared to control.

Fig. 4 is a graphical representation comparing properties of all the water samples kept in *Agnihotra* atmosphere versus control.

There was a general improvement of water quality in all the parameters measured as compared to

control. These changes are consistent through all three replications.

Although there was some difference between the water samples kept in metal containers and the samples kept in bottles regarding DO, pH, and COD, this difference was rather small compared to the difference with control (Fig. 5).

Also, there were some differences between the different kinds of metal containers - but again these differences were small compared to the difference with control. Further, experiments could look deeper into these differences.

The main results with all three replications and all parameters of water quality are that:

- Agnihotra* atmosphere helps to purify water.
- This effect of purification is there whether or not the water samples are kept in Faraday Cages.

The conclusion seems natural that there is some kind of energy field around *Agnihotra* which is not of the known electromagnetic type and which is not shielded by Faraday Cages.

If someone has some alternative explanation it would be interesting to hear about that.

More detailed discussion

The biggest variation between the samples kept in bottles inside the 3 different metal containers was in Dissolved Oxygen (DO). Water kept in stainless steel showed much pronounced effect, while impact was least in water kept in aluminum container.

Also, there was some difference between the samples just kept in bottles and the samples where the bottles were kept in these metal containers acting as Faraday Cages: samples in Faraday Cages showed less improvement. One possible explanation for that result could be related to temperature. It is known that DO is affected much by the prevailing temperature. Temperature in the *Agnihotra* hut was measured before/after *Agnihotra* (at a distance of appr. 50 cm from the fire). Normally the temperature went up by 1°C after *Agnihotra* and came down to the value before *Agnihotra* within 20 or 30 minutes. Probably this small change of temperature which also lasted for a short time band can be neglected.

Possible that metal containers absorb the infrared radiations from the *Agnihotra* fire and store the heat for longer time so that inside the containers the temperature is increased for longer time than outside. But then one would expect the samples in the containers next to the *Agnihotra* fire to have least Dissolved Oxygen (DO) and those furthest away the

Table 1-Raw Data of three replications of the experiment

	DO [mg/L]			pH			COD [mg/L]			Hardness			Coliform/100 ml		
	R1	R2	R3	P1	P2	P3	C1	C2	C3	H1	H2	H3	C1	C2	C3
Control A	3	2,5	3,5	9	9,5	9	70	90	100	210	300	350	900	1000	1100
Control A	3,4	3	3,9	8,8	8,9	9,5	80	95	110	240	355	365	950	1100	1250
Control A	3,8	2,2	2,8	8,6	9,3	9,8	90	100	120	275	375	380	1100	1250	1350
Average control	3,4	2,57	3,4	8,8	9,23	9,43	80	95,00	110,00	241,67	343,33	365,00	983,33	1116,67	1233,33
Standard Deviation	0,40	0,40	0,55	0,20	0,31	0,40	10,00	5,00	10,00	32,53	38,84	15,00	104,08	125,83	125,83
Unshielded bottles	12,2	11	9,8	7,2	6,2	6,9	30	40	50	135	150	165	369	380	440
Unshielded bottles	14	12	10	7,9	7	7,7	32	36	45	125	135	155	420	430	480
Unshielded bottles	12,4	10	8	7,5	6,8	7,8	28	41	55	130	145	170	320	360	400
Unshielded bottles	9,8	8,5	7,9	7,8	6,9	7,8	20	27	35	110	135	145	250	270	295
Unshielded bottles	10,6	8,8	7,8	7,7	6,2	6,9	28	33	50	125	140	170	290	300	335
Unshielded bottles	8,5	7	6,6	7,5	6,5	7,2	38	45	55	135	150	165	250	295	310
Unshielded bottles	9,8	8,2	8,5	7,4	7	7,9	32	33	45	140	160	185	300	290	315
Unshielded bottles	8,5	7,1	6,9	7,2	6,2	6,8	30	38	50	150	175	195	380	400	410
Bottle in Fe-container	12,8	10,2	9	7,7	6,1	6,8	22	39	50	140	165	180	300	325	355
Bottle in Fe-container	11	9	8,2	8	6,9	7,5	22	32	50	140	170	190	420	435	450
Bottle in Fe-container	12	10,5	9,5	7,8	6,5	7,5	24	42	52	125	140	160	290	310	330
Bottle in Cu-container	9,6	7,5	7,8	7,8	6	6,9	30	37	45	135	155	175	410	425	455
Bottle in Cu-container	9	7	6,5	7,8	6,8	7,2	23	37	40	136	155	165	280	295	355
Bottle in Cu-container	10,4	9,54	8,24	7,5	6,5	7	15	30	39	110	135	155	250	280	300
Bottle in Al-container	8,6	7	7,7	8,2	7,2	7,8	24	35	45	150	165	180	370	395	455
Bottle in Al-container	8,9	7,5	6,5	7,9	6,7	7,2	20	40	50	140	150	180	300	320	350
Bottle in Al-container	9,6	8,2	7,5	8,1	7,5	8	18	25	39	120	130	150	232	285	305
Average Agni atm.	10,45	8,77	8,03	7,71	6,65	7,35	25,65	35,88	46,76	132,12	150,29	169,71	319,47	340,88	372,94
Standard Deviation	1,69	1,56	1,09	0,29	0,42	0,43	6,00	5,37	5,83	11,75	13,52	14,19	63,07	58,18	63,86

highest level of DO. The data are not conclusive in this respect. Still, this hypothesis can be tested in future experiments by putting some temperature sensor inside the metal containers.

The main result though is not affected by these variations between the three replications and between the bottles in different materials used for shielding - the significant improvement of water quality of all parameters which were measured if the water is kept in *Agnihotra* atmosphere.

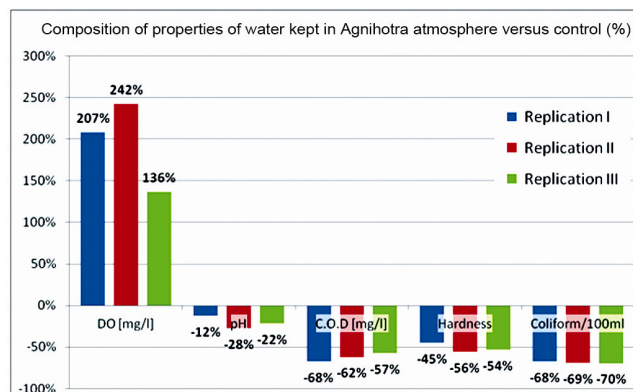
Containers of metals like copper, steel, or aluminum work well as a Faraday Cage to shield electromagnetic waves of a wide range. But if you go to the end of very high energy radiation (like gamma

rays), these containers used cannot prevent rays from penetrating inside. For further studies, it is suggested to do an experiment in which a container of lead is used instead. One centimetre of wall thickness should be enough to at least make a difference in the effect on water. The present study showed some interesting observations in mitigating water pollution problem. Considering importance further systematic research studies are suggested. The experimental design can be modified in different directions:

a) Have samples at different distances from the *Agnihotra* pyramid (The distances inside the *Agnihotra* hut varied from 50 cm to approximately 3 m - this did not have a clear effect on the results).

Table 2 - Percentage changes as compared to control

	Dissolved Oxygen %				pH %				COD %				Hardness %				Coliform/100 ml %			
	Repl. I	Repl. II	Repl. III	Average Repl. I - III	Repl. I	Repl. II	Repl. III	Average Repl. I - III	Repl. I	Repl. II	Repl. III	Average Repl. I - III	Repl. I	Repl. II	Repl. III	Average Repl. I - III	Repl. I	Repl. II	Repl. III	Average Repl. I - III
Average all	207%	242%	136%	191%	-12%	-28%	-22%	-21%	-68%	-62%	-57%	-62%	-45%	-56%	-54%	-52%	-68%	-69%	-70%	-69%
Average stainless steel	251%	286%	162%	228%	-11%	-30%	-23%	-21%	-72%	-60%	-54%	-61%	-44%	-54%	-52%	-51%	-66%	-68%	-69%	-68%
Average copper	184%	212%	121%	169%	-13%	-30%	-25%	-23%	-72%	-64%	-62%	-65%	-47%	-57%	-55%	-54%	-68%	-70%	-70%	-70%
Average aluminum	166%	195%	113%	154%	-8%	-23%	-19%	-17%	-74%	-65%	-59%	-65%	-43%	-57%	-53%	-52%	-69%	-70%	-70%	-70%
Average shielded bottles	200%	231%	132%	183%	-11%	-28%	-22%	-20%	-73%	-63%	-59%	-64%	-45%	-56%	-53%	-52%	-68%	-69%	-70%	-69%
Average unshielded bottles	215%	254%	141%	200%	-14%	-29%	-22%	-22%	-63%	-61%	-56%	-60%	-46%	-57%	-54%	-53%	-67%	-69%	-70%	-69%

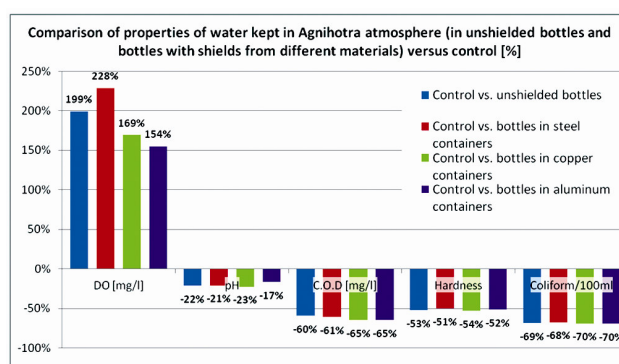
Fig. 4 - Comparison of properties of water kept in *Agnihotra* atmosphere versus control (%)

Samples could be placed outside the *Agnihotra* hut at different distances.

This would also help to see whether the effects of *Agnihotra* energy field inside and outside of the *Agnihotra* hut are same at same distance or not.

b) Put the samples in a room where *Agnihotra* has never been performed before and will be just performed for the 5 days of the experiment. This would help to find out whether the energy field is building up over a period of time.

Possible also to put the samples in an *Agnihotra* hut with continuous *Agnihotra* for several years-but not perform *Agnihotra* during the time of the experiment and see whether the energy field of *Agnihotra* is still present after some time of non-performance.

Fig. 5 - Comparison of properties of water kept in *Agnihotra* atmosphere (in unshielded bottles and bottles with shields from different materials) versus control (%)

c) Keep the samples one day only, two days, etc. to see how fast these changes in water quality happen - and also continue for say 30 days to see whether the improvement continues or stops at some point. Most interesting though is the question: which kind of energy field is created by *Agnihotra* and how this type of energy field brings about the changes in water quality (assuming the possibility of high energy electromagnetic waves which can not be shielded by the type of Faraday Cage used can be excluded).

For future studies, two hypotheses are suggested:

1) There are microorganisms in polluted water which are activated by *Agnihotra* energy field and thus help to improve properties of water.

2) *Agnihotra* creates an energy field in the vicinity which is not confined to electromagnetic fields.

The first hypothesis requires further studies in the field of Microbiology, identifying microorganisms which can help improve water quality and examine closely how their activity is influenced by *Agnihotra* atmosphere.

The second hypothesis puts a challenge for physicists. The pyramid shape of the *Agnihotra* vessel probably plays some role – not much researched yet, but there are some preliminary studies in this field¹¹.

An important study would be: which kind of energy field could this be? One possibility is "*Prana*" energy - but then this concept of "*Prana*" has to be translated into the language of modern science, and especially methods of measuring *Prana* energy will be required¹².

A lot of interesting further studies are necessary, and these could help to get a better understanding of such basic Vedic concepts as "*Prana*" in terms of modern Science. All scientists from different disciplines are invited to join forces!

Acknowledgement

Authors are grateful to Fivefold Path Mission for keeping water samples in the *Agnihotra* hut of their *Goshala* in Maheshwar, and to Shri Umia College, Mandleshwar, and AIMS College, Dhamnod, Madhya Pradesh, for testing the water samples of the experiment.

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- 12 Recently there are different methods which seem to do that - like PIP (Polycontrast Interference Photography), GDV (Gas Discharge Visualization technique, developed by K. Korotkov on the basis of Kirlian photography), and Life Energy Meter measurements. More research with these methods is planned for the future.

Scientific Study of Somyag Yadnya

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Abstract: Somyag Yadnya is a ritual of offerings accompanied by chanting of Vedic mantras derived from the practice in Vedic times. Due to Yadnya fumes and overall process, it affects environmental elements; hence its effects on oxides of sulphur and nitrogen were studied as they are the major air pollutants. Microbial count was also considered during Yadnya. Effects of Somyag Yadnya were studied by collecting surrounding air using handy sampler. SO_x and NO_x levels before Yadnya, during Yadnya and after Yadnya were calculated and compared from collected air. For microbial count nutrient agar plates were opened and count was taken. As per our results, SO_x levels decreases up to 10 times (almost reduces to 90%) that of initial levels due to Somyag Yadnya. NO_x levels increases 10-20 % that of initial levels, but at the end of Yadnya NO_x level reduces that to initial. Microbial count significantly reduces up to 98% due to Somyag. Hence by performing Yadnya air pollution can be controlled.

Keywords: Somyag Yadnya, air pollution, Microbial count, SO_x, NO_x.

1. Introduction

Somyag is a sacrificial ritual in which Soma juice oblations to the deities due to which five elements in the universe (Earth, Fire, Air, Water and Ether) get energizing, in order to bestow prosperity and restore natural equilibrium (Vaidya V. B., Kale Nanaji, 2014). The name of the whole ceremony comes from *soma*, or *somawali*– fresh green stalks of *Ephedra* (WojciechPuchalski, 2009). The Natural cycle of six seasons is accelerated and regulated by the performance of Somyag. Fire ceremony (Somyag Yadnya) plays major role in refining the human thoughts and life process in accordance with the Nature (S. Sushrutha et al., 2014). During the Somyag, *Somawali* is particularly venerated. The stalks woven in a cloth have been conditioned in a special way by exposing them to energies of the ceremony for some days. Then they were ground in stone mortars with water to pour such a juice into wooden holders of various shapes and to use it for offerings to fire and also to drink during the culminant phase of the ceremony, apparently exhaustive for performers. The main goal of such a large ceremony is said to be clearing and healing of atmosphere, water and soils with use of this special fire. (WojciechPuchalski, 2009)

Major pollutants in air are oxides of sulphur and nitrogen. Apart from these pollutants some pathogenic bacteria are also contribute to air pollutions. As Somyag Yadnya heals atmosphere, one need to study its effects at elemental level. During these study effects of fumes on microbial count, SO_x and NO_x level were estimated.

Ahina Dwadasha Ratra Somyag was conducted in Urulu (Devachi), Pune, MH. To study the effects of Yadnya on the surrounding air, samples were collected from 6/2/2014 to 4/3/2014 as described in table 1.

Table 1: Date and time when samples were collected and temperatures were recorded

Date and time	Day	Temp. near Yadnya	Temp. 50 feet apart from Yadnya
6/2/2014 Evening	-1	22.5°C	23°C
7/2/2014 Morning	0	13°C	12.5°C
7/2/2014 Evening	0	23°C	23°C
8/2/2014 Morning	1	12°C	12°C
12/2/2014 Evening	5	27°C	26°C

14/2/2014 Morning	7	12°C	12.5°C
16/2/2014 Evening	9	28°C	27°C
18/2/2014 Morning	11	8.5°C	8.5°C
20/2/2014 Evening	13	30°C	29°C
22/2/2014 Morning	15	14°C	13.5°C
24/2/2014 Evening	17	30°C	29°C
26/2/2014 Morning	19	16°C	16°C
28/2/2014 Evening	21	30°C	29°C
2/3/2014 Morning	23	14°C	14°C
3/3/2014 Evening	24	32°C	32°C
4/3/2014 Morning	25	18°C	18.5°C

2. Method

Air samples were collected from specific positions as described in figure 1.

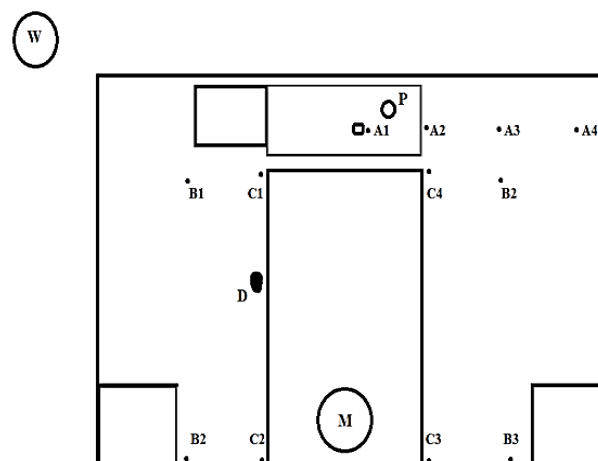


Figure 1: Diagrammatic representation (map) of yadnya and position of sample collection

M- Mahasomyagyadnya. P- Pravargyaaahuti. W- Well. A1, A2, A3, A4- Plates were open at 0 ft, 10 ft, 20 ft, and 30 ft respectively. B1, B2, B3, B4- Place 10 ft apart from the corners where plates were opened. C1, C2, C3, C4- Four corners (vedi) where plates were opened. D- Place where air sample for NO_x and SO_x were collected.

3. Study the effects of fumes on microbial count in the surrounding air -

To study the effect of fumes on microbial count in the surrounding air, method used by Pathade G. and Abhang Pranay (2014) was used. In short, sterilized nutrient agar plates were opened near yadnya and 10 ft, 20 ft, 30 ft apart from the yadnya (as shown in fig.1 positions A1, A2, A3, A4). Experiment was performed in duplicate i.e. two plates were opened at the same position. Plates were also opened at the four corners (vedi) of Somyag (as shown in fig.1 positions C1, C2, C3, C4), and 10 ft apart from the corners (as shown in fig.1 positions B1, B2, B3, B4). Plates were incubated at room temperature for 24 hours and colony count was taken and Graphs were plotted for,

- Average microbial count at 4 corners and 10 ft apart from corners taken at morning and evening for alternative 25 days.
- Microbial count at 4 corners and 10 ft apart from corners taken at morning and evening for alternative 25 days.

I. Estimation of SO_x

SO_x was estimated by improved West and Gaeke method (1956), in short, SO₂ from the surrounding air stream was absorbed in a sodium tetra-chloromercurate solution with the help of Handy sampler. (Spectralab, HDS -8) on alternative 25 days at the position D (as mentioned in fig.1), it forms a stable dichlorosulphomercurate (HgCl₂SO₃)²⁻ complex, which then behaves effectively as fixed SO₃²⁻ in solution. The amount of SO₂ was then estimated by the color produced when p-rosaline-hydrochloride and formaldehyde was added in solution, which can be measured on spectrophotometer at 560 nm. Calibration curve of standard sodium meta-bi sulphate was used for SO_x estimation by using following formula-

$$\text{SO}_x \text{ in ppm} = \frac{\mu\text{g of SO}_2/\text{mL (from calibration curve)}}{\text{Volume of air sampled / L}} \quad (\text{by volume})$$

$$\mu\text{g/m}^3 \text{ of SO}_x = \frac{\text{ppm by volume} \times 64 \times 10^6}{24470}$$

II. Estimation of NO_x -

NO_x was estimated by modified Jacobs - Hochheiser method (1972), in short, NO₂ in air was collected by scrubbing a known volume of air through an alkaline solution of arsenite with the help of Handy sampler (Spectralab, HDS -8), on alternative 25 days at the position D (as mentioned in fig.1). The nitrite ions thus formed was reacted with sulfanilamide and N-(1-naphthyl) ethylenediamine (NEDA) in phosphoric acid to form the colored azo dye, which can be measured on spectrophotometer at 540 nm. The method was standardized statistically by using NaNO₂ standards. Standardization is based upon the empirical observation that 0.74 mole of NaNO₂ produces same color as 1 mole of NO₂. SO₂ can be removed using H₂O₂.

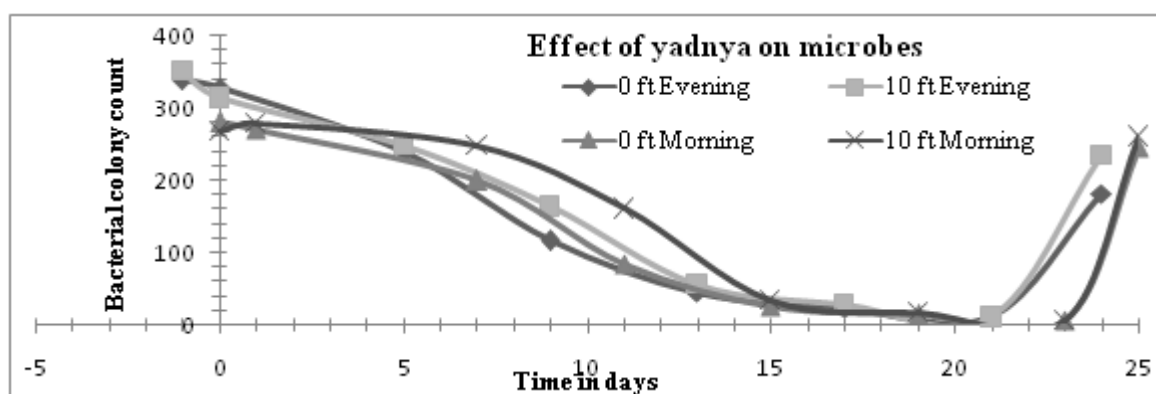
$$\mu\text{g NO}_x/\text{m}^3 = \frac{\mu\text{g of NO}_2/\text{mL (from calibration curve)} \times \text{volume of reagent}}{0.85 \times \text{volume of air sampled in m}^3}$$

$$\text{NO}_x (\text{ppm}) = \mu\text{g of NO}_x/\text{m}^3 \times 5.32 \times 10^{-4}$$

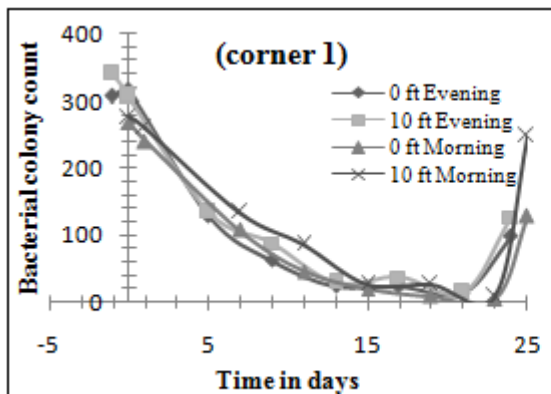
4. Results

4.1 Effects of fumes on microbial count in the surrounding air

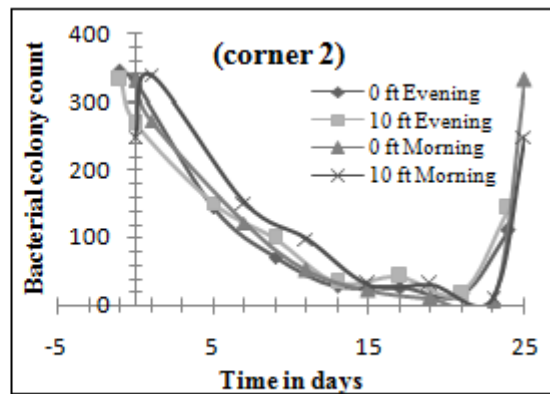
As per the results, microbial count in the air decreases up to 95% due to fumes of the yadnya. Average colony count before yadnya (day -1 and 0) was 346 colonies which get reduced to 12 colonies at the last day of yadnya (day 23). Microbial count is least near the yadnya (0 ft), and increases as distance increases (As in graph 1). As compare to the average of microbial count, taken before yadnya (i.e. 305 colonies on day -1 and 0) was reduces up to 81%, 79%, 77%, 72% at 0 ft, 10 ft, 20 ft, 30 ft respectively (an average of count at specific positions, i.e. 56 colonies at 0 ft, 62 colonies at 10 ft, 69 colonies at 20 ft and 85 colonies at 30 ft), during yadnya.



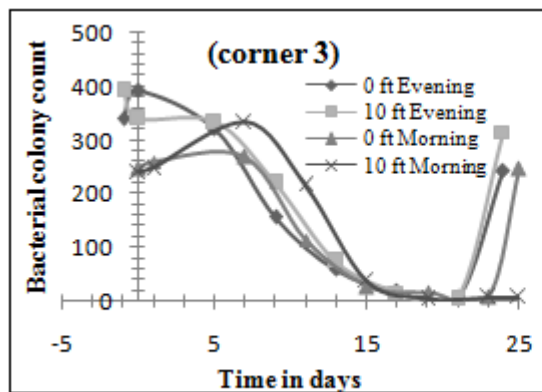
Graph 1: Effect of fumes on microbial count taken at the corners (average count)



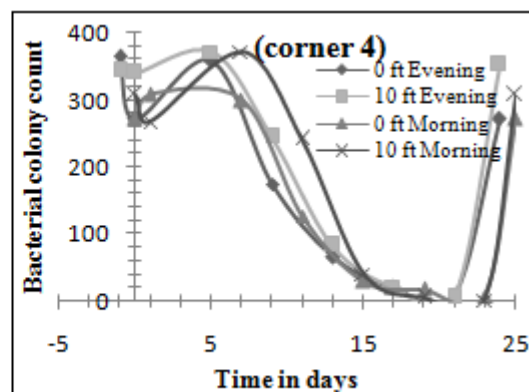
Graph 2



Graph 3



Graph 4



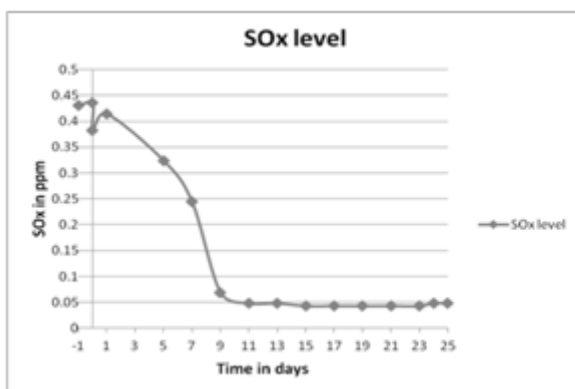
Graph 5

Graphs 2,3,4,5. - Effect of fumes on microbial count at corner 1,2,3,4 respectively taken in the morning and evening. Microbial count is less in all four corners as compare to 10 ft apart from the respective corners. Average count at 10 ft apart from corner (113 colonies) was 18% more as compare to an average count at respective four corners (94 colonies). (Red and purple lines are above the blue and green lines in the graph 2, 3, 4 and 5). Microbial count was least during the period day 15 to day 23, but it increases after the yadnya (i.e. day 24 and 25). It was during

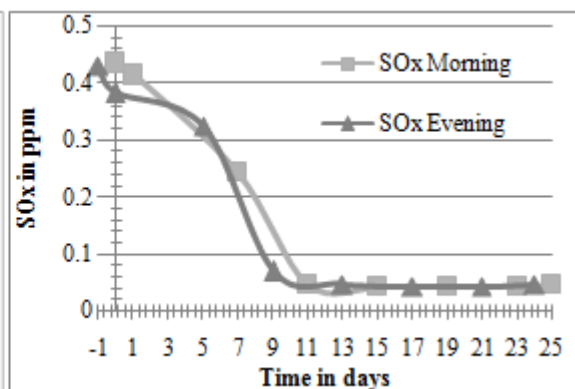
those days when Somyag yadnya was performed. Microbial load in the air can be reduced by performing yadnya daily.

4.2 Estimation of SO_x

SO_x level decreases during and after yadnya up to 10 times that of initial (Reduces from 0.43 ppm to 0.048 ppm). SO_x level remains decreased after the yadnya (at least up to 2 days) was finished (as in Graph 6). SO_x pollution in the air can be reduce up to 90% by performing yadnya.



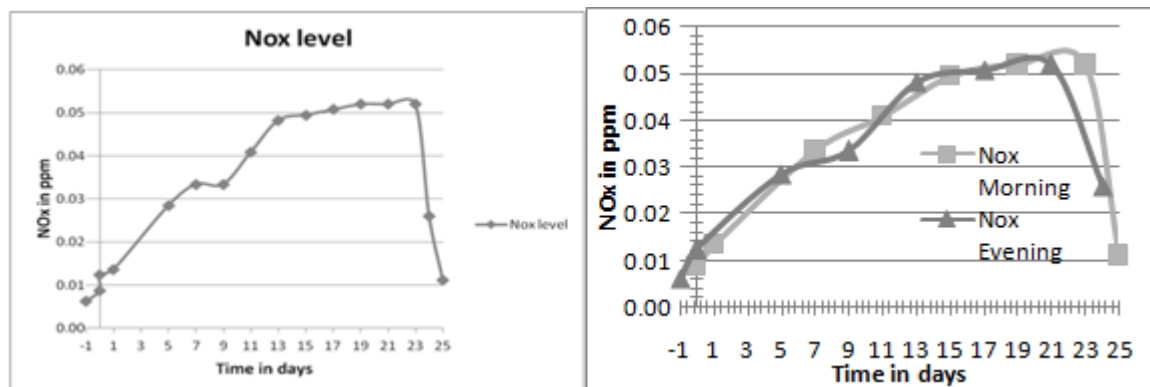
Graph 6: SO_x levels in morning and evening during 25 days



4.3 Estimation of NO_x

NO_x level increases during Yadnya up to 0.05 ppm, but also decrease to normal level (0.01 ppm) after Yadnya (on day 24

and 25). NO_x level increases up to 20% as compare to initial (day -1 and 0) NO_x levels (Graph 7).



Graph 7: NOx levels in morning and evening during 25 days

Standard NO_x (mostly NO₂) level provided by 'National Ambient Air Quality Standards' (NAAQS) as well as 'Maharashtra Pollution Control Board' is 0.053 ppm (annual average per hour). Maximum value recorded was 0.052 ppm (during day 19 to 23) which is less as compare to standard levels.

5. Conclusion

Due to Somyag yadnya microbial load in the air can be reduced up to 95%. Many of the bacteria present in the surrounding environment may be killed or inactivated due to Somyag Yadnya. SO_x levels decreases up to 90% which is long term effect due to Yadnya. Although NO_x levels increases due to Somyag, it was reduced to its initial levels. As per results NO_x levels does not exceeds standard or threshold levels. Results show that Somyag Yadnya can control air pollution due to microbes and oxides of sulphur and nitrogen.

6. Acknowledgement

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Author Profile



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Scientific study of Vedic Knowledge Agnihotra

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Objective:

To study effect of Agnihotra fumes on:

1. **Expt No: 1:** Microbial count in the surrounding air
2. **Expt No: 2:** plant growth
3. **Expt No: 3:** NO₂ level
4. **Expt No: 4:** SO₂ level

To study effect of Agnihotra ash on:

1. **Expt No: 5:** Skin disease of animal and humans.
2. **Expt No: 6:** Seed germination
3. **Expt No: 7:** Genotoxic chemicals (colchicine and methyl parathion)
4. **Expt No: 8-11:** Bacterial pathogenecity.
5. **Expt No: 12:** Water purification using Agnihotra ash

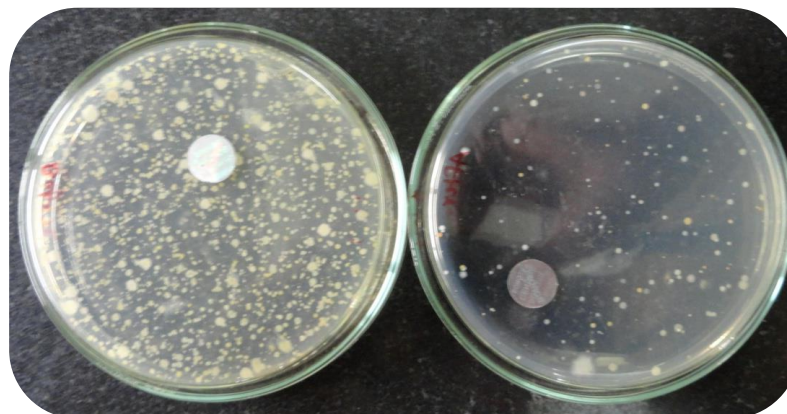
Study of different components in Agnihotra:

1. **Expt No: 13:** Time- sunrise time, sunset time and any time (between sunrise and sunset)
2. **Expt No: 14:** Mantra- with mantra (sunrise and sunset) and without mantra
3. **Expt No: 15:** Rice- brown rice (unpolished) and white rice (polished)
4. **Expt No: 16:** Ghee- cow ghee and buffalo ghee
5. **Expt No: 17:** Pot- copper pot and steel pot of same size and shape

TO STUDY EFFECT OF AGNIHOTRA FUMES

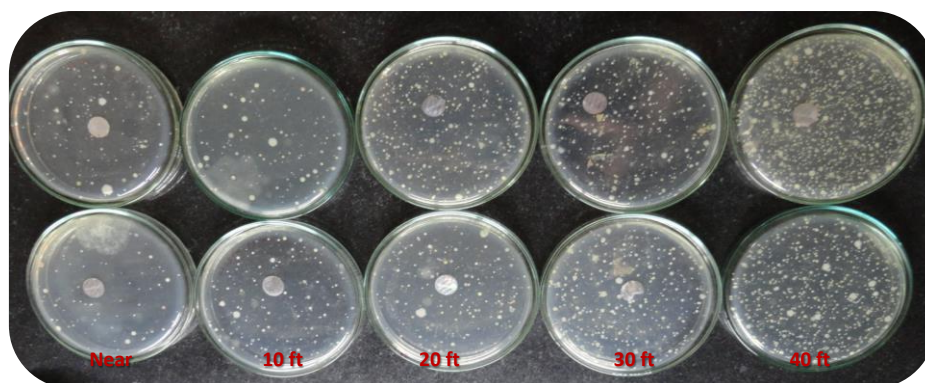
Expt No: 1: Microbial count in the surrounding air

- Medium (nutrient agar) plates were open in room before and after Agnihotra and incubated for 24 hr at room temperature to grow bacterial colonies.
- Also plates were opened 0, 10, 20, 30, 40 feet apart from Agnihotra and colony count was taken after 24 hr incubation at room temperature.



Before

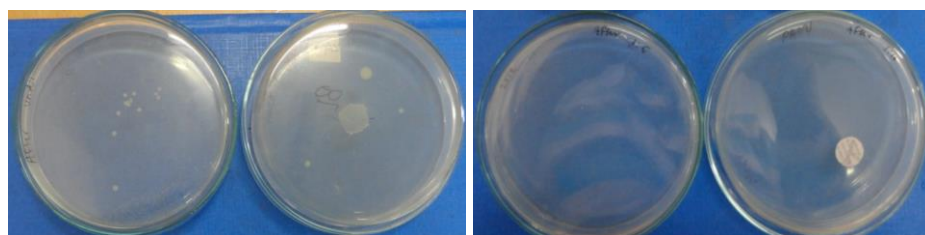
After



- Known amount of air sample is collected in sterile 35 ml nutrient medium, before and after Agnihotra. Sample was diluted as undiluted, 1:1, 1:5 and 1:10. Diluted sample were spread on nutrient agar plates and incubated for 30 hr. to grow bacterial colonies.



Before Agnihotra



After Agnihotra

Conclusion-

As per results obtained, Agnihotra fumes decreases microbial load in air.

Up to 30 feet microbial load in the air can be control by performing Agnihotra.

Expt No: 2: To study effect of Agnihotra fumes on plant growth

2 plants were maintained providing same amount of water, light and other environmental conditions. One is kept in separate room where Agnihotra is performed and another is kept in normal room where Agnihotra is not performed.

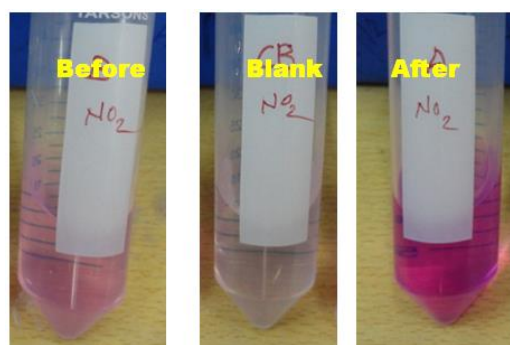


Conclusion-

It shows that due to Agnihotra fumes plant growth is more as compare to normal plant.

Expt No: 3: Effect of Agnihotra fumes on NO₂ level

NO₂ in air is collected by scrubbing a known volume of air through an alkaline solution of arsenite. The nitrite ions thus formed is reacted with sulfanilamide and N-(1-naphthyl) ethylenediamine (NEDA) in phosphoric acid to form the colored azo dye, which can be measured on spectrophotometer at 540 nm. The method is standardized statistically by using NaNO₂ standards. Standardization is based upon the empirical observation that 0.74 mole of NaNO₂ produces same color as 1 mole of NO₂. SO₂ can be removed using H₂O₂.



Calculations for sample before Agnihotra-

1. O.D. at 540 nm = 0.104
2. μg of NO₂/ml from graph = 0.1644 μg /ml
3. volume of air sampled
 $V = (F_1 + F_2) / 2 \times T \times 10^{-3}$
 Flow rate = 1.5 ml/min
 Time of sampling = 2 hr = 120 min
 $V = (1.5 + 1.5) / 2 \times 120 \times 10^{-3}$
 $V = 0.18 \text{ m}^3$
4. level of NO₂
 $= (\mu\text{g of NO}_2/\text{ml} \times \text{volume of absorbing reagent}) / 0.85 \times V$
 $= (0.1644 \times 15) / 0.85 \times 0.18$
 $= 16.1152 \mu\text{g} / \text{m}^3$
5. NO₂ in ppm = level of NO₂ $\times 5.32 \times 10^{-4}$
 $= 0.00857 \text{ ppm}$

Calculations for sample after Agnihotra-

1. O.D. at 540 nm = 0.122
2. μg of NO₂/ml from graph = 0.1928 μg /ml
3. volume of air sampled
 $V = (F_1 + F_2) / 2 \times T \times 10^{-3}$
 Flow rate = 1.5 ml/min
 Time of sampling = 2 hr = 120 min
 $V = (1.5 + 1.5) / 2 \times 120 \times 10^{-3}$
 $V = 0.18 \text{ m}^3$
4. level of NO₂
 $= (\mu\text{g of NO}_2/\text{ml} \times \text{volume of absorbing reagent}) / 0.85 \times V$
 $= (0.1928 \times 15) / 0.85 \times 0.18$

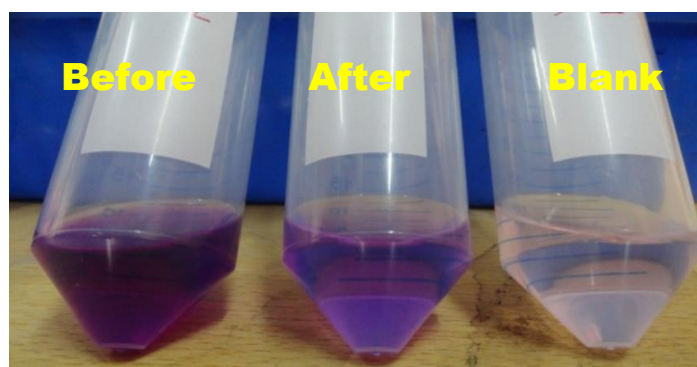
$$= 17.6471 \mu\text{g} / \text{m}^3$$

$$5. \text{ NO}_2 \text{ in ppm} = \text{level of NO}_2 \times 5.32 \times 10^{-4}$$

$$= 0.00939 \text{ ppm}$$

Expt No: 4: Effect of Agnihotra fumes on SO₂ level

SO₂ from the air stream is absorbed in a sodium tetra-chloromercurate solution, it forms a stable dichloro sulpho mercurate complex, which then behaves effectively as fixed SO₃⁻² in solution. The amount of SO₂ is then estimated by the color produced when p-rosaline-hydrochloride and formaldehyde is added in solution, which can be measured on spectrophotometer at 560 nm.



Calculations for sample before Agnihotra-

1. O.D. at 560 nm = 0.203
2. μg of SO₂/ml from graph = 0.2589 μg /ml
3. volume of air sampled
 $V = (F1+F2)/2 \times T \times 10^{-3}$
 Flow rate = 1.5 ml/min
 Time of sampling = 2 hr = 120 min
 $V = (1.5+1.5)/2 \times 120 \times 10^{-3}$
 $V = 0.18 \text{ m}^3$
4. SO₂ in ppm = (μg of SO₂ per ml from graph) / volume of air sampled
 $= 0.2589 / 0.18$
 $= 1.4381 \text{ ppm}$
5. $\mu\text{g} / \text{m}^3$ of SO₂ = (ppm of SO₂ $\times 64 \times 10^6$) / 24470
 $= 3761.34$
6. SO₂ ($\mu\text{g} / \text{m}^3$) at 25 °C and 760 mm(Hg) = $\mu\text{g} / \text{m}^3$ of SO₂ \times volume of absorbing reagent
 $= 3761.34 \times 15$
 $= 5.642 \times 10^4 \mu\text{g} / \text{m}^3$

Calculations for sample after Agnihotra-

1. O.D. at 560 nm = 0.079
2. μg of SO₂/ml from graph = 0.1007 μg /ml
3. volume of air sampled
 $V = (F1+F2)/2 \times T \times 10^{-3}$
 Flow rate = 1.5 ml/min
 Time of sampling = 4 hr = 120 min
 $V = (1.5+1.5)/2 \times 120 \times 10^{-3}$
 $V = 0.18 \text{ m}^3$
4. SO₂ in ppm = (μg of SO₂ per ml from graph) / volume of air sampled

$$= 0.1007 / 0.18$$

$$= \mathbf{0.5597 \text{ ppm}}$$

$$5. \mu\text{g} / \text{m}^3 \text{ of SO}_2 = (\text{ppm of SO}_2 \times 64 \times 10^6) / 24470$$

$$= 1463.77$$

$$6. \text{SO}_2 (\mu\text{g} / \text{m}^3) \text{ at } 25^\circ \text{C and } 760 \text{ mm(Hg)} = \mu\text{g} / \text{m}^3 \text{ of SO}_2 \times \text{volume of absorbing reagent}$$

$$= 1463.77 \times 15$$

$$= \mathbf{2.1957 \times 10^4 \mu\text{g} / \text{m}^3}$$

Results-

NO₂ level in the surrounding atmosphere is increased from 0.0086 ppm to 0.0094 ppm due to Agnihotra fumes (performed at sunset).

SO₂ level in atmosphere reduces from 1.44 ppm to 0.56 ppm due to Agnihotra fumes (performed at sunset).

To study effect of Agnihotra ash on

Expt No: 5: Effect of Agnihotra ash on skin disease of animal and humans.

Agnihotra ash was mixed with pure ghee to make an ointment which was applied to the infected ear (showing red rashes) of pet cat as well as to the infected thumb (showing peeled off skin with wound) of a lady, whose hand comes in touch with detergent and water everyday because of washing and cleaning the vessels and the clothes.

After one month of treatment (3times/day) with the above mixture cat's ear became totally normal in comparison with the control (only ghee), whereas the thumb infection did not disappear totally but appears to be recovered compared to the control.



Conclusion: Agnihotra ash can be used to make **ointment** to treat skin diseases.

Expt No: 6: Effect of Agnihotra ash on seed germination-

To study effect of Agnihotra ash on germination of seeds, following water were used-

- tap water,
- control ash water (1 gm normal ash + 100 ml water) and
- Agnihotra ash water (1 gm Agnihotra ash + 100 ml water)

Seeds of *Vigna aconitifolia* and *Vigna unguiculata* were taken as experimental material. Seeds were allowed to germinate and germination was observed every after 24 hrs.

Observations-



Tap water

control ash

Agnihotra ash

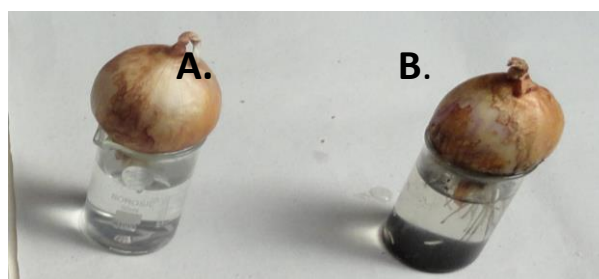
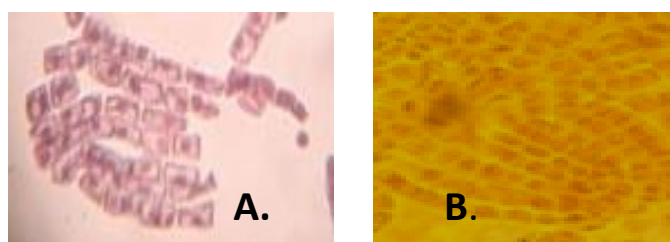
Conclusion-

From results obtained it can be concluded that Agnihotra ash promoted the process of germination probably by increasing its nutrient content and hence can be used as **fertilizer**.

Expt No: 7: To study neutralization of genotoxic effect by Agnihotra ash-

To study neutralization of genotoxic effect by agnihotra ash onion root tips were used. The Onion roots were allowed to grow separately in

- tap water,
 - water containing Agnihotra ash,
 - water containing control ash,
 - water containing Colchicine
 - Water containing Colchicine and agnihotra ash.
 - water containing Methyl Parathion
 - Water containing Methyl Parathion and agnihotra ash.
- Growth of roots was measured in cm. after 7 days. Root tips from each sample were taken and different stages of Mitosis were observed.
 - Arresting of mitosis (no spindle formation) and small growth (rigorous) of root tips were taken as toxic effect, while normal mitosis and elongated root tip taken as normal growth or non-toxic.



- A. Containing genotoxic chemical (colchicine)
- B. Containing genotoxic chemical (colchicine) + Agnihotra ash.

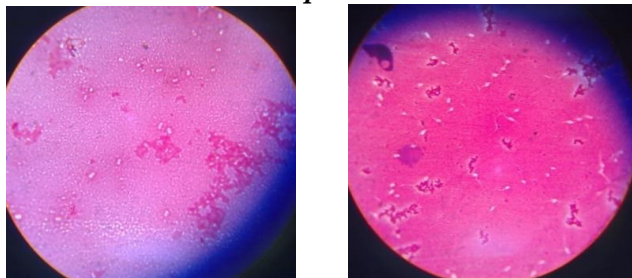
Conclusion-

Agnihotra ash showed activating effect on cell division and also neutralises toxic effect of Colchicine and Methyl Parathion.

Expt No: 8-11: Effect of Agnihotra ash on bacteria.

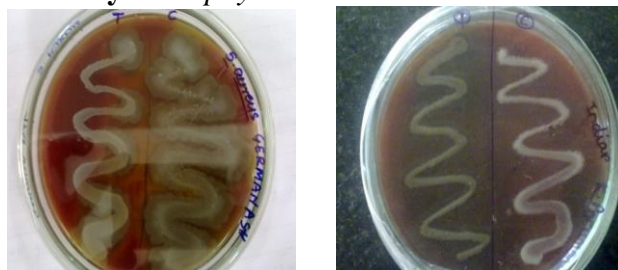
The Bacteria selected were Pathogenic as well as some commensal and non pathogenic, were exposed to Agnihotra Ash and observed for changes in the properties like

Expt No: 8: Loss of Capsule formation in *Klebsiella pneumonia*



It is evident from Table that upon exposure to Agnihotra ash the capsule forming ability of *Klebsiella pneumoniae* was reduced.

Expt No: 9: Loss of haemolytic activity in *Staphylococcus aureus* and *Klebsiella pneumonia*

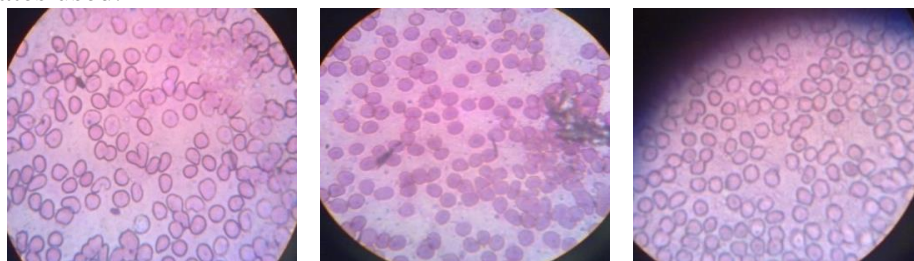


Haemolytic ability of *K. pneumoniae* and *S. aureus* was reduced upon exposure to Agnihotra ash.

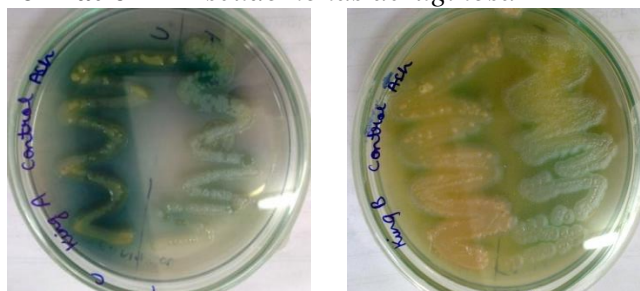
Expt No: 10: Decreased resistance to phagocytosis,

Human blood 5ml + 0.5 ml bacterial suspension, incubate at 37°C for 1 hr and blood stain it observe cell no engulfed (use direct bacteria and also exposed to Agnihotra ash for 1 hr)

Decreased resistance to phagocytosis (more no of bacteria engulfed by phagocytes) was observed for all the four Bacterial isolates used.



Expt No: 11: Loss of pigment formation in *Pseudomonas aeruginosa*



Pigment production ability of *Pseudomonas aeruginosa* was reduced upon exposure (use direct bacteria and also exposed to Agnihotra ash for 1 hr)to Agnihotra Ash.

Expt No: 12: Water Purification using Agnihotra ash:

1. 1 L tap water + 10ml sewage (for coliform contamination) (positive control) : sample A
2. 1 L tap water (negative control)
3. sample A water 100 ml + 5 gm Agnihotra ash, incubate at overnight at RT and then perform MPN

Results- Sample A showed MPN positive, while tap water and ash treated sewage mixed water showed MPN negative

Conclusion- Agnihotra ash removes water pathogens and purifies it.

Study of different ingredients in Agnihotra-

To study the effect of time, mantra, rice, ghee and pot on Agnihotra ash we used following parameters-

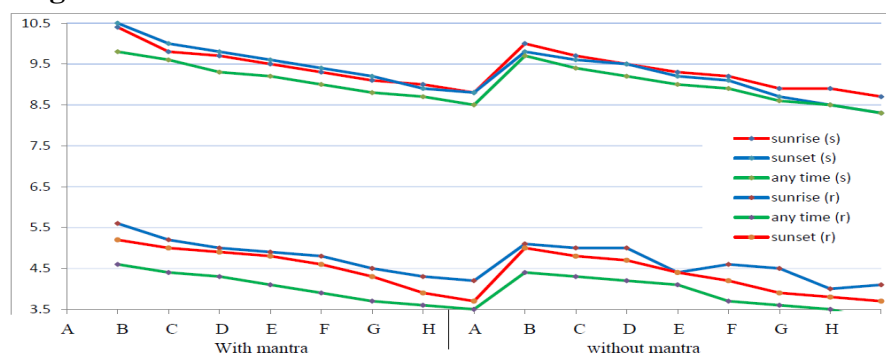
1. **Expt No: 13:** Time- sunrise time, sunset time and any time (between sunrise and sunset)
2. **Expt No: 14:** Mantra- with mantra (sunrise and sunset) and without mantra
3. **Expt No: 15:** Rice- brown rice (unpolished) and white rice (polished)
4. **Expt No: 16:** Ghee- cow ghee and buffalo ghee
5. **Expt No: 17:** Pot- copper pot and steel pot of same size and shape

We prepare 48 ashes with combinations of different parameters such as time, mantra, rice, ghee and pot. Moong (*Vigna aconitifolia*) seeds were allowed to grow in respective 48 ashes, providing same environmental conditions and after 2 weeks plant growth was measured by considering shoot and root length.

- Plant growth in all 48 ashes is **more** as compare to control.
- Graphs for different parameters are created using following A to H ashes-
 - A. Brown rice, cow ghee, copper pot
 - B. Brown rice, cow ghee, steel pot
 - C. Brown rice, buffalo ghee, copper pot
 - D. Brown rice, buffalo ghee, steel pot
 - E. white rice, cow ghee, copper pot
 - F. white rice, cow ghee, steel pot
 - G. white rice, buffalo ghee, copper pot
 - H. white rice, buffalo ghee, steel pot

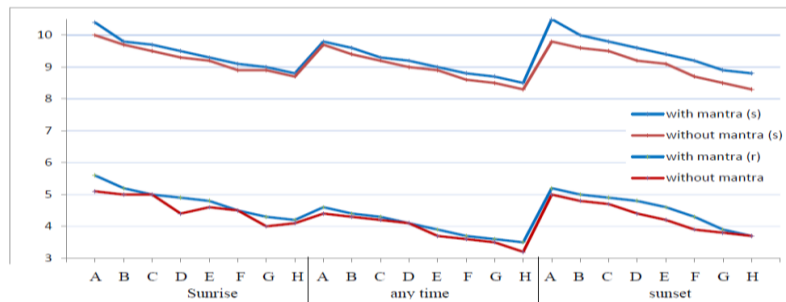
Results-

1. Effect of time on Agnihotra



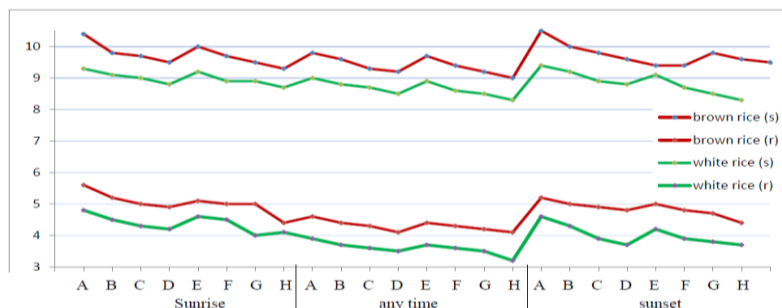
Plant growth is more in sunrise (blue line) and sunset (red line) ashes as compare to any time (green line) ashes. Also root growth is more in sunrise ashes than in sunset ashes.

2. Effect of mantra on Agnihotra-



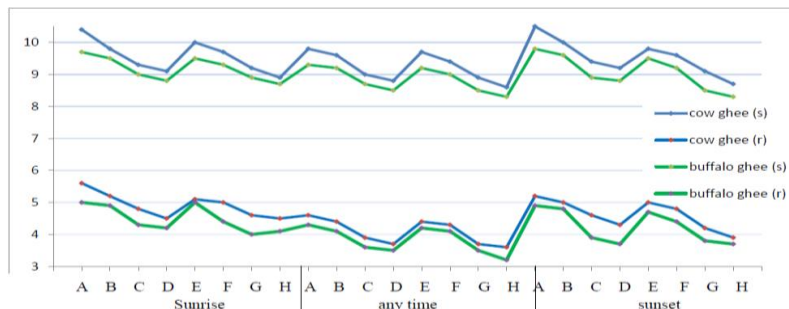
As per graph, we can conclude that plant growth in ashes with mantra (blue lines) is more as compare to plant growth in ashes without mantra (red lines).

3. Effect of rice on Agnihotra-



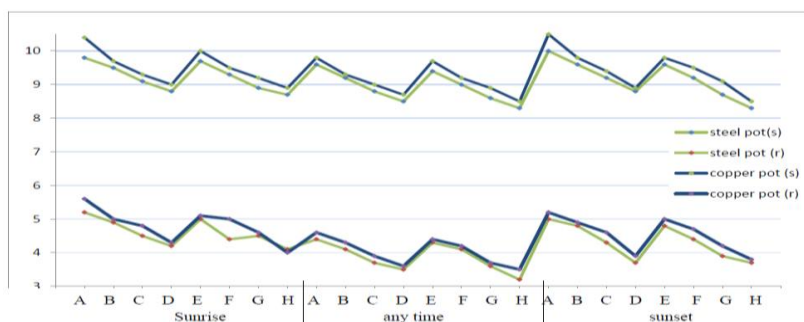
As per graph, we can conclude that plant growth in ashes with brown or unpolished rice (red lines) is more as compare to plant growth in ashes with white or polished rice (green lines).

4. Effect of ghee on Agnihotra-



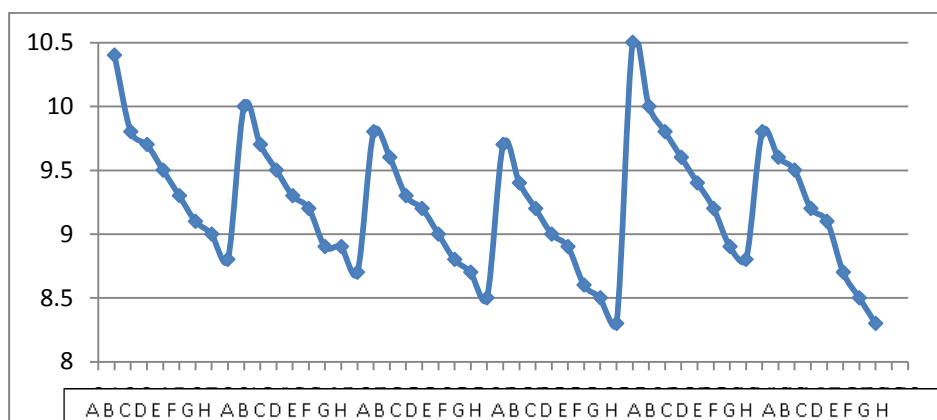
Plant growth in ashes with cow ghee (blue lines) is more as compare to plant growth in ashes with buffalo ghee (green lines).

5. Effect of pot on Agnihotra-



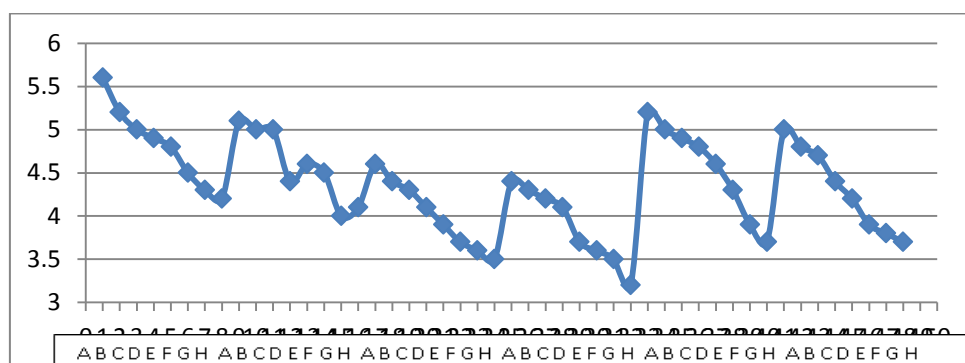
Plant growth in ashes prepared in copper pot (blue lines) is more as compare to plant growth in ashes prepared in steel pot (green lines).

6. Combine effect of rice, ghee and pot on shoot length-



As per graph combine effect of brown rice, cow ghee and copper pot (points A) shows more shoot growth as compare to other (i.e. B to H). It shows peak at 'A' point.

7. Combine effect of rice, ghee and pot on root length-



As per graph combine effect of brown rice, cow ghee and copper pot (points A) shows more root growth as compare to other (i.e. B to H). It shows peak at 'A' point.

Conclusion-

Plant growth is better observed in ashes prepared with brown rice, cow ghee, copper pot, with mantra and at sunrise, sunset timings.

The combination of brown rice, cow ghee and copper pot shows good plant growth.

Higher plant growth is observed in ashes prepared in copper pot, with brown rice and cow ghee, with mantra and performed at sunrise and sunset timings (Ash no. - 1 and 33).